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QUEENSLAND AGRICULTURAL JOURNAL

Dairy Cows on Pasture in the Brisbane District.

LEADING FEATURES

Kikuyu Grass.
Water Distribution.
Dairying Overseas.
Acetonaemia of Dairy Cattle.
Tobacco Pest Control.
Papaw Growing.
Feeding Dairy Cows.
Maize for Poultry.
Egg Marketing.

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

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(Lists of extension services in Central and North Queensland will appear in the next issue.)

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Tuberculosis-Free Cattle Herds.

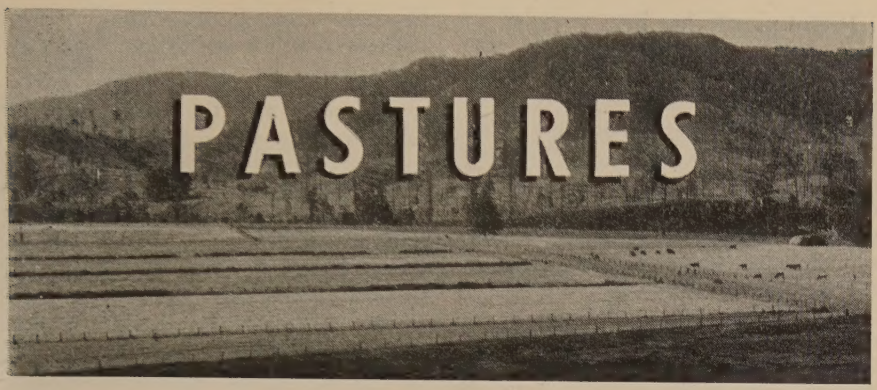
TESTED HERDS (As at 21st July, 1954).

The Tuberculosis-Free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements.

The studs listed here have fulfilled the conditions to the date shown above.

Full particulars of the scheme and Agreement for Testing forms may be obtained from the Under Secretary, Department of Agriculture and Stock, Brisbane, or from Divisional Veterinary Officers throughout the State.

Breed.	Owner's Name and Address.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, "Bingegang," Dingo
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy
	Sullivan Bros. "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," Greenmount
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
	C. K. Roche, Freestone, Warwick
	Mrs. K. Henry, Greenmount
	D. R. Green, Deloraine Stud, Durong, Proston
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	C. A. Edwards, "Grasmere" Jersey Stud, Woodford
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
Polled Hereford	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	E. W. G. McCamley, Eulogie Park, Dululu



Kikuyu Grass.

BY OFFICERS OF AGRICULTURE BRANCH.

Kikuyu grass (*Pennisetum clandestinum* Hochst.) is a native of the Kenya uplands, and since its introduction to Australia in 1919, it has found considerable favour as a pasture for dairy cattle, chiefly in areas of summer rainfall.

As kikuyu requires a temperate to subtropical climate with a good rainfall and deep fertile soils for its best development, its distribution in Queensland is mainly confined to such districts as the Atherton Tableland, Eungella Range, Blackall Range, Toowoomba, Crows Nest, Kingaroy, Killarney, Beechmont and certain north coast dairying districts where these conditions occur.

Areas suited to paspalum will usually grow good kikuyu, and swards of paspalum and kikuyu are commonly found in high-rainfall dairying districts.

Heavy black soils which tend to dry out and crack extensively in winter or spring are not suitable for kikuyu.

Not infrequently kikuyu grass is used most effectively as a lawn.

DESCRIPTION.

Kikuyu grass is a summer-growing perennial grass which, under suitable conditions, spreads rapidly over and through the ground by means of running stems. Both the surface runners and the underground stems root freely at the nodes, anchoring the plants firmly in the ground and forming a dense turf which withstands heavy trampling by stock. The stems carry a large quantity of leaf, and the stems themselves are very succulent. Under favourable conditions, kikuyu grass makes a dense growth, often as much as two feet high.

Flowering and seed setting have been recorded in each month of the year, but are most common in late autumn and spring. The inflorescence, which is borne in the leaf axil, is small and inconspicuous and is most obvious on dewy mornings when the delicate creamy flower parts glisten in the sunlight. The seeds are carried in the leaf axils and can be found only by dissecting the leaf sheath.

When the mature seed is eaten by stock with other herbage, the seeds are passed out intact in the dung. Following a short maturation period, rapid germination occurs. At present, no known methods exist for the commercial harvesting of kikuyu seed.

CLIMATIC REQUIREMENTS.

Whilst kikuyu is adaptable to a wide range of climatic conditions, best growth in Queensland is usually obtained in moist subtropical areas.

Useful growth has been recorded on the Darling Downs and in the Warwick district, where average annual rainfall is 30 in. or less. In the Kingaroy area (altitude about 1,400 ft., average annual rainfall 28.8 in.) excellent growth can be obtained in waterways associated with soil conservation projects. Actually, on the red volcanic loams kikuyu grass is so vigorous as to present a potential risk as a weed of cultivation. However, even on poor gravelly hillsides in this area, kikuyu will grow and persist quite well.

Isolated areas have also been established in melon-hole brigalow country, where rainfall rarely exceeds 25 in. per annum, but growth is usually stemmy and the flag somewhat sparse.

In general, it can be accepted that kikuyu grass will not survive as a permanent pasture in areas where the annual rainfall is less than 35 in. per year, unless the rainfall is reasonably well distributed throughout the year or unless the subsoil moisture is artificially improved, as happens in water disposal lines associated with mechanical soil conservation measures.

Kikuyu can withstand moderately heavy frosts and for this reason it has proved of value for late autumn and early winter grazing. During the flush summer months paspalum is usually more palatable to stock than kikuyu, but when winter frosts and dry conditions prevent paspalum growth, kikuyu becomes the principal pasture grass in many dairying areas. It is able to withstand heavy grazing and trampling during winter months, and has the ability to recover rapidly following early summer rains.

METHOD OF PLANTING.

Kikuyu is usually established from cuttings, runners or turves. Quickest coverage of land is obtained from turves. These have been found to be best for land subject to heavy weed growth, for stony hillsides, and for other situations where a quick cover is desirable. However, the extra labour involved in collecting and

Plate 1.

Kikuyu Pasture, Showing Flush Growth 12-18 in. High, Suitable for Grazing.

Plate 2.

Kikuyu Grass Pasture on the Atherton Tableland.
Mt. Bartle Frere in Background.

transporting the planting material is a drawback to extensive use of this method.

When cuttings or runners are used, arable land should be ploughed and harrowed, and the material planted at intervals of three feet in drills run out a similar distance apart. The cuttings are best covered by hoeing earth onto them, leaving about one-third of the length of each cutting protruding from the soil. The soil is then firmed about each cutting by trampling.

If a paddock is carrying only a light covering of grass, the land may be given a shallow ploughing. The cuttings are planted in each third or fourth furrow as the ploughing proceeds. This procedure is not desirable on any but the best soils.

On medium class soils, the soil fertility should be built up before planting kikuyu grass.

When the grass is planted on hillsides, contour furrows made by a double run of a mouldboard plough should first be run across the slope at vertical intervals of approximately two feet. After the furrow slice is broken down with a suitable implement, kikuyu turves are planted at intervals of 3–6 feet along the furrow.

In many instances it is desirable to use fertilizer for quick establishment and rapid initial cover. Fertilizer mixtures containing one part sulphate ammonia to two parts superphosphate at 2-3 cwt. per acre have proved economical and suitable.

For very rapid effective cover of banks of dams and watercourses, cuttings, lawns and so on, planting at intervals of a foot is recommended.

The best planting time for vegetative material is in the February-March period, when seasonal rains and suitable soil temperatures will foster rapid growth.

Despite the very vigorous nature of kikuyu grass, legumes such as white clover will persist and thrive in association with the grass, particularly in areas where soil fertility and climatic conditions favour the establishment of pasture legumes. Seed of white clover, at 2 lb. per acre, should be sown in any new kikuyu land, particularly on plateaux and coastal scrub soils.

In certain Darling Downs areas, excellent winter growth of black medic

and native vetch has been found in association with kikuyu grass in areas with an average annual rainfall as low as 29 in.

MANAGEMENT.

Newly planted kikuyu pastures usually make slow progress in the first year of establishment, and any management practice designed to induce quick cover is advantageous. Stocking rates should be light until vigorous growth of runners has occurred and all bare soil is covered.

Weed growth can often be troublesome, particularly on scrub soils. This emphasises the need for quick establishment. Where possible, turves planted at intervals of three feet should be used under these conditions. Where the land surface permits, mowing will help to control weed growth, but this is not practicable on rough country or on unstumped scrub lands.

Once established, the grass is very tenacious and will withstand heavy grazing. Correct management practices, including subdivisional fencing, rotational grazing and renovation, help to maintain the vigour of the pasture.

If an old kikuyu grass sward becomes unproductive, severe renovations and rotary hoeing during wet season periods will restore its productivity. Drastic renovation may be impracticable on steep slopes, but a modified form of renovation can be undertaken. For this purpose, implements such as scalloped disc harrows are eminently suitable.

Dung harrowing, whilst desirable, is not so necessary as with paspalum or couch pastures, because in wet scrub areas the vigorous stolons quickly break up the dung patches.

FERTILIZER PRACTICES.

When adequately fertilized with farmyard manure, kikuyu will maintain a dark-green colour, but in old,

Plate 3.

Young Kikuyu Seedlings Extracted from Manure Heaps.

Plate 4.

Kikuyu Pasture is Very Suitable for Pigs.

poorly managed stands or in areas subject to severe leaching or a high water-table, a distinct yellowing of the leaves becomes noticeable. Such yellow pastures will respond to the application of a nitrogen-rich fertilizer mixture. The use of artificial fertilizer in areas receiving 45 in. or more of rain per annum can be recommended for improving growth. Blood and bone fertilizer, at 3–4 cwt. per acre, or a nitrogen/phosphate fertilizer mixture at 3 cwt. per acre, will restore colour and promote rapid growth if applied during the spring and summer months.

In closely stocked areas, where intensive subdivision and rotational grazing are practised, a heavy accumulation of manure can be relied upon to maintain growth.

In areas where white clover grows, lime and phosphatic fertilizers should be added if the soil is deficient in this respect, in order to foster vigorous development of the legume. The legume in turn will build up the nitrogen status of the soil and so benefit the grass.

As kikuyu produces much bulk each season, a rapid build-up of organic matter in the surface soil occurs, with a resultant increase in the soil's capacity to absorb and retain rainfall. The management of kikuyu pasture should be designed to conserve this organic matter, particularly on shallow soil types where rapid drying out occurs.

CONSERVATION.

Kikuyu is somewhat difficult to cut and rake, and is also difficult to cure evenly. However, some excellent samples of both hay and ensilage have been made from excess growth despite the problems associated with mechanical harvesting.

FEED VALUE.

The palatability of kikuyu grass is excellent, and its food value is good. The leafy portions of the plant, of course, have the highest nutritive value. The pasture should therefore be managed so as to keep the grass

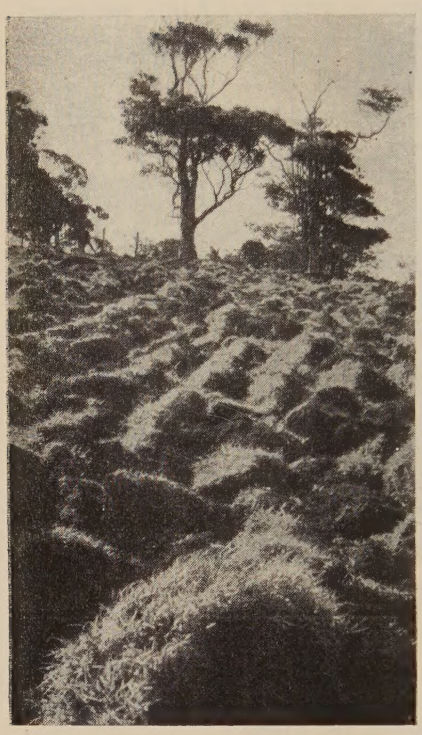


Plate 5.

Severe Renovation of Kikuyu Pasture by Disc Ploughing.

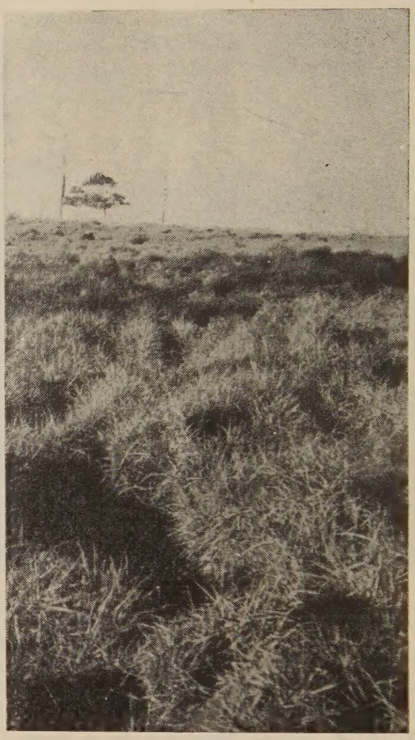


Plate 6.

Kikuyu Regrowth Following Renovation Treatment as Shown in Plate 5.

fairly short and leafy for the grazing animals. Kikuyu will grow well under climatic conditions too cold for paspalum, and thus will provide better winter and early spring grazing than the latter. In dry times, the succulent stems can be grazed judiciously without destroying the pasture.

Although the flush periods associated with paspalum in February and March are not so apparent in kikuyu pasture, nevertheless the latter, owing to its longer growing season, is capable of giving, over a 12-month period, as great a total yield as paspalum.

The composition of kikuyu grass compared with that of paspalum grass and Rhodes grass is shown in Table 1.

TABLE 1.

CHEMICAL COMPOSITION OF KIKUYU, PASPALUM AND RHODES GRASSES ON AN AIR-DRY BASIS.

Grass.	Crude Protein.	Crude Fat.	Crude Fibre.	Lime.	Phosphoric Acid.
	%	%	%	%	%
Kikuyu, young shoots	16·7	1·4	31·2	0·436	0·884
Kikuyu, old plants	8·8	1·4	27·1	0·416	0·697
Paspalum, young shoots	20·6	1·6	23·7	0·412	0·618
Paspalum, old stemmy growth	4·1	0·9	41·4	0·239	0·139
Rhodes, young leafy growth	16·4	1·7	27·1	1·999	0·724
Rhodes, old stemmy growth	5·8	1·2	33·3	0·579	0·604

SPECIAL USES.

In addition to its value as a stock food, kikuyu by virtue of its vigorous

creeping habit has proved to be useful in controlling weeds and in checking soil erosion.

In areas where bracken fern and other weeds are troublesome, kikuyu has exhibited the ability to compete with weed growth and to provide grazing for cattle in weedy pastures. If cattle can be made to forage for kikuyu planted amongst bracken fern, the trampling results in marked reduction of the fern population. Preliminary hand brushing and the use of hormone weedicides will further assist in weakening weed growth and thus allow the grass to replace weeds.

On steep slopes, cuttings, and other situations where soil erosion is a hazard, kikuyu should be planted freely, as it will act quickly as an efficient soil binder. It can also be used effectively to grass waterways, pondage banks, banks of dams, creeks, and so on.

Planting around cowyards and dairy buildings is recommended to reduce the dust menace and to utilise waste water as well as to provide alternate grazing for young calves.

For pig grazing, kikuyu is regarded highly, and with the build-up of soil fertility in small enclosed areas, plants quickly spread and provide dense ground cover. Pigs will eat kikuyu pasture readily, and piggeries planted to this grass may be independent of other sources of green feed.

ERADICATION.

Kikuyu grass has many desirable features as a pasture species, but it can be troublesome in cultivations because of the difficulty in checking growth by ordinary cultivation techniques in areas favouring the grass. In general, it is not advisable to plant kikuyu in a paddock unless the intention is not to crop the paddock regularly again.

Eradication, of course, does not present any particular problems in those areas which are marginal for satisfactory kikuyu growth. In the areas of high rainfall there are usually two or three months of the year when rainfall is low. During this dry period, ploughing, harrowing, and raking will check kikuyu grass

Plate 7.

A Good Cover of Kikuyu Grass has Stabilised a Gully on the Darling Downs.

severely and this treatment usually is quite adequate to enable a good summer cultivation crop to be grown. Further harsh treatment of this type will destroy a kikuyu grass stand.

PESTS AND DISEASES.

Kikuyu is relatively free of disease, though a number of leaf blights have been recorded. Disease problems are usually seasonal and do not reduce pasturage to any extent.

Pests similar to those which attack paspalum can cause serious damage to kikuyu grass. These include white grubs and funnel ants, which may damage roots, whilst army worms and caterpillars may ravage the foliage. However, due to the habit of producing runners, recovery is usually rapid.

PASTURE RENOVATION AT COOROY.

A dairy pasture improvement project being undertaken by Mr. W. A. Badham, of Tewantin Road, Cooroy, is being watched with considerable interest by other dairy farmers in the district.

Mr. Badham is introducing legumes into six-and-a-half acres of sloping pasture land which has been carrying mat grass and paspalum since it was cleared 40 years ago.

When the newly-established pasture has made sufficient growth, it is proposed to manage it by controlled grazing, using an electric fence.

The work on Mr. Badham's farm is one of the projects being carried out this year under the Commonwealth Dairy Extension Grant. He is receiving technical advice from Mr. G. Cassidy, Adviser in Agriculture at Gympie, and Mr. H. J. Smith, Dairy Officer at Cooroy, both of whom are officers of the Department of Agriculture and Stock.

Soils on the 6½-acre demonstration plot are shallow yellow-brown clays, and analyses indicate that they are strongly acid and low in available phosphorus.

Mr. Badham first renovated his land using a tandem scalloped disc harrow. Three harrowings were necessary before the land was in a condition suitable for contour furrowing and topdressing.

With a double-furrow mouldboard plough, contour furrows were run out at vertical intervals of three feet. Lime and fertilizer were then applied at the rates of one ton of pulverised limestone and two bags of superphosphate per acre.

Early in April, when soil moisture conditions were satisfactory, a mixture of legume seeds was sown broadcast and harrowed in with the tandem disc. Lucerne and white clovers (Ladino and New Zealand white) were sown at the rate of 1 lb. per acre, and Montgomery red clover at 2 lb. per acre.

Good germination was reported 8-10 days after sowing, and after a month, during which 268 points of rain were registered, the lucerne and red clover were each three inches high and the white clovers were two inches high.

Kikuyu grass has since been planted in the pasture furrows.

TESTING PASTURE SPECIES.

The major problem associated with pasture improvement work in Queensland is raising the plane of animal nutrition during the winter and spring months.

In the Warwick-Inglewood-Goondiwindi area, where winter rains are somewhat more reliable than in some other parts of the State, it is possible that this might be achieved by using pasture species which grow during the autumn, winter and early spring. In addition, there is little doubt that the carrying capacity of pastures in these districts will be greatly increased by the establishment of summer-growing species such as Rhodes grass, green panic, lucerne and phasey bean.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently that pasture trials designed to test different varieties of grasses and legumes and their response to fertilizer treatments have been established by the Department with the co-operation of landholders in the district. The pasture species being examined include phalaris, white clover, red clover, subterranean clover, Rhodes grass, green panic, buffel grass, phasey bean and lucerne.

Tobacco Pest Control Schedule for the 1954-55 Season.

By W. A. SMITH, Entomologist, Science Branch.

Further field testing of insecticides and soil fumigants by this Department and observations on the use of dieldrin by growers during 1953-54 season have led to a revision of the schedule issued last year for the control of tobacco pests.

Dieldrin gave good control of all the leaf pests except budworm*. Against that insect, it was not as effective as DDT. The material endrin now recommended is an improvement on dieldrin for the control of the tobacco looper, and will control other leaf and stem pests, such as cluster caterpillar, leaf and stem borer. Its effectiveness against budworm is not yet known accurately, but there is good reason to believe that it will be more effective than dieldrin.

CONTROL SCHEDULE.

In Seedbeds.

Prepare the seedbed site early and eliminate as many weeds as possible.

Sterilize the beds and paths before planting. This may be achieved in varying degrees by firing, steaming or fumigating.

Spread a layer of medium grade river sand to a depth of one-eighth of an inch on the beds after planting, as protection against seed-harvesting ants.

Examine the seedbeds closely at time of seedling emergence for the activity of leaf-harvesting ants. If present, spray around the beds with dieldrin or endrin and spot spray any nests on the beds.

Two weeks after germination, or earlier if obviously necessary, commence light weekly spraying with endrin or dieldrin. The spray should be directed horizontally from each side of the bed and should be applied after the last watering for the day.

* The scientific names of the insects and nematodes mentioned appear at the end of this article.

Give the seedlings a thorough spraying with endrin or dieldrin a day before pulling for transfer to the field.

In the Field.

Nematodes must be considered early. Where the history of the land suggests these pests may limit yields or reduce leaf quality sufficiently to warrant action, fumigate the soil when in good tilth with DD or EDB at least three weeks before planting out. The recommended acre dosages are 10 gallons of DD or 10 gallons of 12½% EDB. Fumigation depth should be 6 inches, with thorough sealing after application. The intended planting line may be treated by a single application along the centre of the row or by one 6 inches on each side of it.

During the first three weeks after transplanting, spray with endrin or DDT. DDT dust may be used, but sprays are more effective against the mixed pests.

Later sprayings should be timed by observations on the presence of young stages of the leaf pests. Applications of endrin at approximately 10-day intervals may prove sufficient if spraying is thorough. Complete cover should be the objective—that is, both sides of each leaf should receive a film of the insecticide. When budworm is prevalent, spraying to protect plant hearts will be required more frequently.

Either endrin or dieldrin will control the looper, leaf miner and cluster caterpillar. If both the looper and budworm, however, are operating as major pests and only dieldrin is available, DDT should be added. In such a spray both insecticides should be used at their recommended strengths.

If budworm is the only pest operating, the dry bait restricted to the heart of the plant will give the most economical control. Greater protection of the upper leaves will be obtained by rapidly spraying the top of the plant with DDT as an alternative measure.

Insecticides and insecticide strengths recommended for use in tobacco fields are as follow:—

(1) *Endrin.*—Strength of spray, 0.05% active ingredient.

(2) *Dieldrin.*—Strength of spray, 0.05% active ingredient.

(3) *DDT.*—Strength of spray, 0.1% active ingredient preferably in the emulsion form; strength of dust, 2%.

(4) *Lead arsenate.*—To prepare budworm dry bait, thoroughly mix 1 lb. lead arsenate with 20 lb. bran, pollard or maizemeal.

Soil fumigants and detailed dosage rates are:—

(1) *DD. Machine application.*

Treatment in the centre of row position—1 pint to 2 1/16 chains (136 feet),

or

Treatment 6 inches each side of row position—1 pint from each outlet to 4⅛ chains (272 feet).

Hand injector application.

Same positions as for machine application but with injections 1 foot apart. Rate: 1 fluid ounce per each 7 injections for centre of row treatment, and 14 injections totalling 1 fluid ounce for the other treatment.

(2) *EDB.* Use a concentrate of 12½% by volume active ingredient at the same rates as for DD.

WARNINGS.

To avoid the risks of undesirable taints and residues, insecticides should be used on tobacco only when necessary. Dieldrin and endrin should not be used in excess of the recommended rates, particularly near harvesting.

A health risk is involved if dieldrin or endrin is inhaled, ingested or absorbed through the skin. Care should be taken to avoid inhaling these insecticides or being unduly wet by spray. Splashes of the concentrates should be washed off immediately with soap and water and any clothes which are splashed should be changed immediately and not worn again until they have been washed.

SCIENTIFIC NAMES OF PESTS.

Budworm	*Heliothis armigera* (Hb.)
Cluster caterpillar	*Prodenia litura* (F.)
Leaf miner	*Gnorimoschema operculella* (Zell.)
Looper	*Plusia argentifera* Gn.
Nematodes	*Meloidogyne* spp. (previously listed as *Heterodera marioni* (Cornu) Goodey)
Stem borer	*Gnorimoschema heliopa* (Low.)

VOL. III. OF THE "QUEENSLAND AGRICULTURAL AND PASTORAL HANDBOOK."

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Irrigation Practice in Queensland.

Part 5. Special Methods of Water Distribution.

By A. NAGLE, Irrigationist, Agriculture Branch.

In the preceding sections, mention has been made of the main irrigation systems in use or likely to be used in Queensland. There are, however, a number of modifications of each system which are in operation in irrigation areas for special conditions and for specific crops. These are discussed here.

CONTOUR FURROW METHOD.

The contour furrow method is used to some extent in Queensland for the irrigation of tobacco, vegetable crops and orchards.

In this method the furrows are run on the contours, or rather sufficiently off the true contours to give the required grade to allow of the steady flow of irrigation water down the furrows. Contour furrows are used where the topography is too broken and the grade too steep to permit the use of ordinary furrow distribution of water, and also in areas of fairly high rainfall where soil erosion problems arise.

However, land with very uneven contours is difficult to irrigate and cultivate efficiently owing to the irregularity of row spacing to conform with the contours. With steep land also furrows have to be made with a big cross section so as to overcome side fall.

In contour planting of orchards the tree rows depart from the straight line to maintain a correct grade, though usually some grading is done before planting to avoid unnecessary curves in the rows.

At the Bureau of Investigation's Irrigation Research Station at Gatton, an experiment has been designed to ascertain whether the planting of contour rows of summer pastures could give effective water distribution with a minimum of grading on steep broken contoured land. The results to date indicate that a measure of control is possible if the interrow space is cultivated and furrowed.

Plate 1.

Pastures Irrigated by the Contour Row Method at Gatton Irrigation Research Station.

BORDER CHECK IRRIGATION.

This method is similar to the border or bay method except that cross checks are placed at right angles to the flow of water to form small rectangular basins. It is used on land where there is no regular slope and on heavy soils where flooding of the land is required to ensure efficient water penetration.

Rice is sometimes irrigated by the border check method, but in New South Wales irrigation of rice is by the contour bank system.

CONTOUR CHECK BANKS.

In the contour check bank method the banks are erected across the slope on the contour lines, a fall of 3–4 in. between banks being general practice. As the banks follow the contour lines the bays are of irregular shape, and on very flat land the distance between the banks may be too wide. A bay width of 3 chains is considered the maximum, consistent with effective irrigation. On very flat land it would be necessary to have closer spacing of banks.

Usually little grading is done with this method of irrigation, so the water coverage in the bays will vary, low spots being overwatered. Water is distributed from the supply channel to each bay, but provision is also made for draining excess water into the bay below.

Contour check bank irrigation is used for rice growing in the Murrumbidgee area, but is also used for irrigation of annual winter pastures (subclover-Wimmera ryegrass) and for production of cereal and fodder crops.

This method tends to encourage excessive use of water, especially on permeable soils, as the amount applied cannot be closely controlled. In Queensland where at present water supply is limited, the method could not be recommended for general use.

The contour check bank system can be used on land which is considered too steep for development of the border system. Contour banks are constructed at vertical intervals of three feet and in addition

shallow contour furrows are run at 6-inch vertical intervals to prevent any tendency to erosion and to effect better distribution of water. With a good stand of pastures these small furrows need not be reformed.

The irrigation water is conveyed along the ditch at the upper side of each contour bank, and is distributed through the bank by means of outlets as for border irrigation. Distribution is more efficient if water from the outlets is diverted into a shallow ditch which has been ploughed along the lower side of the bank by throwing one furrow back against the bank. This allows of a uniform flow over the lower edge of the furrow, and gives a good spread of water over the top of the field.

These outlets also serve as drainage facilities to the bay below. Water naturally concentrates in the low spots and the excess water can be redistributed for irrigation in the next lower bay by using water control boxes as drainage outlets. This method is still being developed experimentally and appears to have some possibility for irrigation of summer pastures on slopes too steep for use of border irrigation.

BASIN METHOD.

The basin method is used for irrigation of orchards by forming a small rectangular basin around each tree. Sometimes groups of trees are included in one basin. This method has some merit on heavy soils where furrow irrigation does not give sufficient absorption and also in porous soils where limited side movement of water occurs in furrow irrigation.

Water may be delivered directly into each basin from a ditch or may be run from basin to basin with a connecting furrow.

SUB-SURFACE IRRIGATION.

This method is not capable of general use, as there are few localities to which such a system would be suited.

The requirements for sub-surface irrigation are a level or gently sloping piece of land with a porous topsoil underlain by an impervious layer. The impervious layer of clay or hardpan should be at a depth of 1½–2 ft. for shallow-rooted vegetable crops and 4–6 ft. for orchard irrigation.

A large quantity of water is used, as the water is required to wet the entire subsoil. The water is conveyed through the field in parallel ditches and these ditches are used for drainage where necessary.

A more practicable method of sub-surface irrigation is by means of parallel lines of agricultural tiles placed 18–20 ft. apart and at a depth of 16–18 in., the tiles being laid with uncemented joints as for drainage to allow of adequate penetration and distribution of water.

This method is not likely to be used in Queensland to any extent.

BORDER DITCH.

The border ditch is a modified form of the border system. Instead of parallel check banks, small ditches are formed down the slope, the earth from the ditch forming check banks on each side of the border ditch, which is connected with the drainage system.

This method is adapted to flat land with defective drainage, as openings can be made in the banks to allow drainage of water from low areas in borders.

The Papaw.

By G. W. J. AGNEW, Senior Experimentalist, Horticulture Branch.

The papaw (*Carica papaya*, fam. *Caricaceae*) is a small herbaceous tree which reaches a height of 15-20 feet and bears a crown of large, light-green, palmate leaves. It is probably indigenous to Central America.

Plant development is at its best in districts with an equable climate characterised by high temperatures and a good annual rainfall. Many excellent plantations (Plate 1) are to be found along the Queensland coast, the main centres of production being Redlands, Sunnybank,

Plate 1.

Papaw Plantation in Southern Queensland. The older plants are 15 months old and bearing fruit. Young plants are in the foreground.

Brookfield and Aspley in the Metropolitan district, the Mary Valley and Gunalda in the North Coast district, Yarwun and Mackay in the Central district, and Cairns in North Queensland.

FLOWER TYPES.

In the papaw plant there are three primary flower types—namely, pistillate, staminate and hermaphrodite (Plate 2). Individual trees may bear one, two, or very rarely, all three of these. The periods during which more than one flower type occur are, however, generally short.

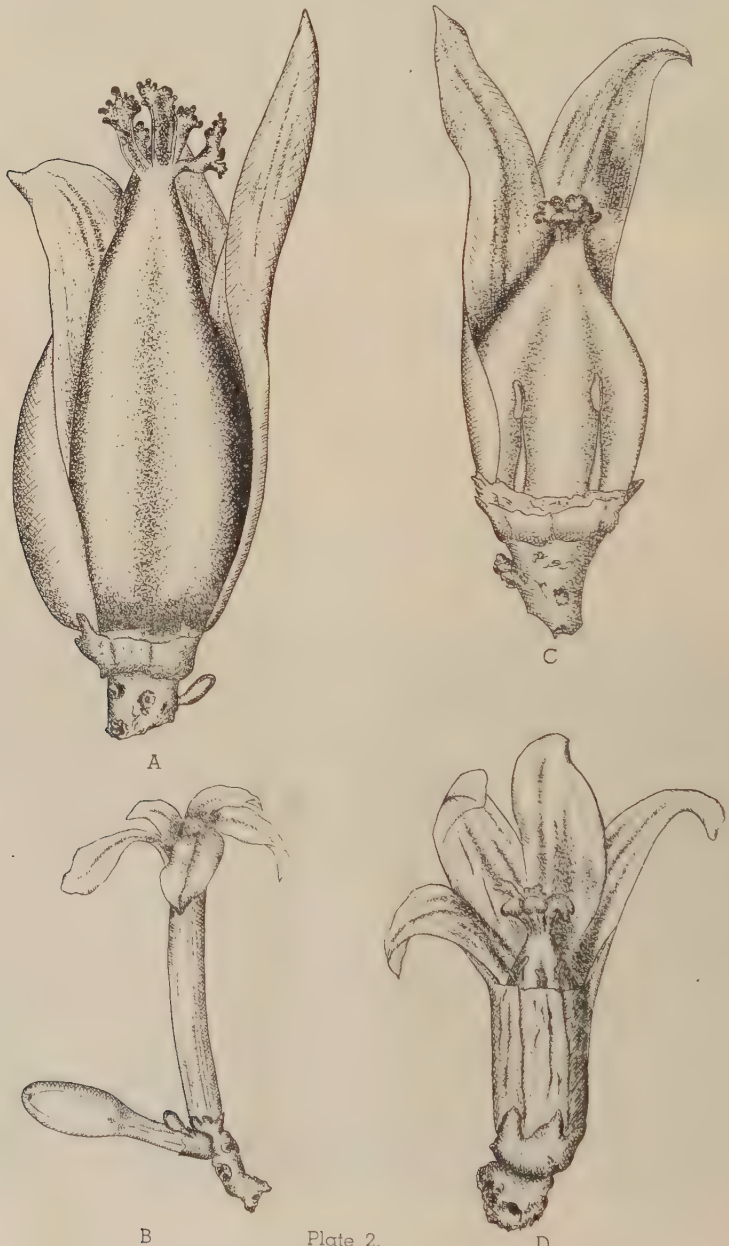


Plate 2.

Flower Types in the Papaw. A, Pistillate. B, Staminate. C, Pentandria. D, Elongata.

The five petals of the pistillate or female flower (Plate 2, A) are free for their entire length and surround the flask-shaped pistil in the centre. The lower bulbous part of the pistil is the ovary which develops into the fruit.

In staminate or male flowers (Plate 2, B), the petals are fused together for slightly over half their length and form a slender tube which bears 10 stamens. The pistil is non-functional and staminate flowers cannot produce fruit.

Hermaphrodite flowers of the papaw have the structural characters of both sexes and are classified into three forms—pentandria, intermediate and elongata.

The *pentandria* form (Plate 2, C) is somewhat similar to the pistillate flower except that a large stamen occurs near the base of each petal and lies along a groove on the outer surface of the ovary. Pentandria flowers produce a typically squat fruit with deep grooves and well-defined basal petal scars.

Plate 3.

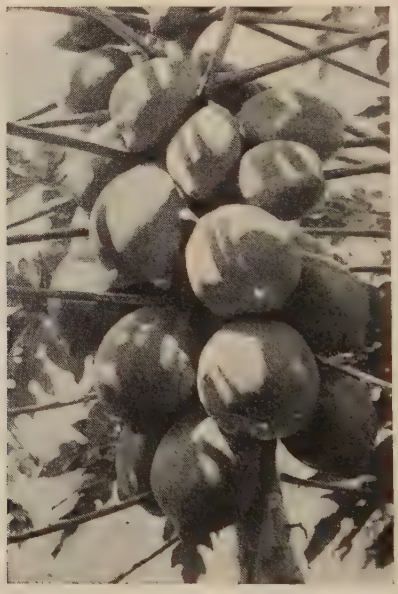
Tree Types in the Papaw. The female of this dioecious variety is at the left and the male at the right. Note the pendulous fruit developed from hermaphrodite flowers on the male tree.

The *intermediate* form comprises an indefinite group of freakish and distorted flowers in which the stamens and the pistil occur in grotesque combinations. Fruits produced by intermediate flowers are extremely irregular in shape and of little commercial value.

The *elongata* form (Plate 2, D) is the commonest hermaphrodite flower. It has an elongate pistil partly enveloped by the petals, which form a collar around the ovary. Elongata flowers give rise to long fruits with a small seed cavity often characterised by deep fissures.

TREE TYPES.

When, as in some strains of the papaw, pistillate and staminate flowers are borne on different plants, the species is said to be dioecious (Plate 3). Trees bearing pistillate flowers only are termed "females", while those which normally bear staminate flowers are referred to as "males".



A

B

C

D

Plate 4.

Fruit Types in the Papaw. Derived from—A, pistillate flower; B, pentandria flower; C, elongata flower; D, intermediate flower.

The flowers of a female papaw tree are produced in the leaf axils on single or simply-branched stalks varying from one to several inches in length, according to the characteristics of the strain. The principal flower is borne at the apex of the flower stalk and small subsidiary flowers are situated nearer the base. Fruits produced by the pistillate flowers (Plate 4, A) of female trees are usually rounded-oval in shape, but common irregularities occur in the form of beaked fruits or fruits which taper at the stem end.

The flowers of a male tree are produced in large numbers on profusely branched stalks, which attain a length of from three to five feet. Some male trees bear a number of reduced hermaphrodite flowers at the terminals of these stalks, particularly during the cool spring and autumn months. These hermaphrodite flowers may produce fruit which is extremely variable in quality (Plate 4) and often of little market value.

In hermaphrodite trees, the flowers are normal, with both stamens and a pistil. They are produced on short stalks in the axils of the leaves, and the subsidiary flowers near the base of the stalk are in many instances either functionally staminate or abnormal hermaphrodites. At times, staminate flowers may be almost exclusively produced and the tree then functions as a male tree for a limited period. *Pentandria, elongata* and *intermediate* flower forms frequently occur on the same hermaphrodite tree, with the first two predominating from time to time during the flowering season. In some trees, however, one of these (usually *elongata*) predominates throughout the life of the plant. In Queensland, trees which bear practically all *elongata* flowers characteristically produce long, narrow fruit popularly called "Long Toms" (Plate 4, C).

VARIETIES.

Many distinct papaw varieties have been bred in Queensland or introduced from overseas countries. Those of particular interest in current plant improvement work are:—

Bettina.—A dioecious type derived from Betty (a Florida selection) and a Queensland strain. It is a squat bushy tree carrying smooth, rounded-oval fruits weighing 3-5 lb. and with good external and internal colour.

Improved Petersen.—A dioecious type derived from a local strain. The tree is tall and bears a single fruit in each leaf axil. The skin colour of the fruit is poor and its carrying qualities are only fair but the colour and flavour of the flesh are excellent.

Bettina x *Improved Petersen Hybrids* show remarkable vigour and crop well. They retain most of the plant and fruit characteristics of Bettina.

Hortus Gold.—A dioecious type introduced recently from South Africa. It is somewhat prone to premature leaf fall but matures the plant crop early. The fruit is 2-3 lb. in weight, rounded-oval in shape and with a golden skin colour.

Hawaiian Solo.—A hermaphrodite type grown extensively in Hawaii. The tree is tall and although it flowers late in the summer, its fruits mature at about the same time as other varieties in South Queensland. The fruit is small, weighs about 1 lb., and is pear-shaped in hermaphrodite trees and round with slight grooves in female trees. It is a firm-fleshed fruit with a smooth skin.

Nearly all commercial plantings in Queensland are grown from open-pollinated seed and usually consist of a mixture of plant types. The range of types in any one plantation depends on the source of the

seed used, and whether or not the grower practises hand pollination in the parent plants from which seed is derived. In the latter case the stock may show a considerable degree of uniformity.

The papaw is very subject to environmental conditions and locally selected types are generally planted. These differ a great deal in some essential characters.

Characters of importance in the selection of plant types from which seed is obtained are:—

Size and Shape of Fruit.—Smooth-surfaced, oval or rounded-oval fruits weighing 3-4 lb. are readily saleable as fresh fruit and suitable for canning purposes.

Skin Colour.—A uniform rind colour is desirable. Summer ripened fruits usually have a more even colour and fewer blemishes than those which mature in the cool months.

Fruit Flavour.—Flavour is a distinctive character which varies with the season at which the fruit matures. Broadly, there appear to be two distinct flavours, the musk and the nasturtium or cress. The former is preferred by Queensland consumers.

Flesh Quality.—Flesh thickness is influenced by the varietal type and the amount of seed in the fruit. A thick but not hard flesh is desirable for both the fresh fruit and canning trades.

SEEDBEDS.

In southern Queensland, papaw plants are usually raised in seed boxes filled with a free sandy loam, the seed being sown in drills about two inches apart at a depth of half an inch. When the seedlings are two inches high they are pricked out and transferred to seedbeds with a 4-inch spacing between plants.

Alternatively, the seed may be broadcast over the seedbed and raked out to a spacing of about three inches; the seedbed is then covered with half an inch of sandy soil and pressed or rolled.

A third method is to plant the seed in small containers with about three seeds to the container, the containers being placed in the seedbed area, where they will receive proper care and attention. Frequent watering is necessary to ensure a good germination and the seed boxes or seedbeds should be under partial shade at least when the plants are young.

In the tropics, the seed is frequently sown direct in the field, when weather conditions are favourable for rapid germination, and covered with a light mulch.

Fresh seed should be used, as its viability declines rapidly within a few weeks after extraction from the fruit unless the seed is thoroughly dried and stored at low temperatures. In summer, germination takes place in from 12 to 20 days. The quantity of seed sown depends on the tree spacing in the proposed plantation. If the trees are to be planted on the standard square system with an 8 ft. x 8 ft. spacing, about 4 oz. of air-dried seed should be sown for each acre of the plantation. A heavier sowing rate is necessary when the seed is sown directly in the field, for it is usual to plant about 10 seeds in each tree position.

Papaw seed may be sown at any time during the summer months. Plantations established from seed sown in early summer grow vigorously and the first crop of fruit is usually set high on the stem. This is an undesirable feature in the plantation and the general practice in southern Queensland is to sow the seed in December and transplant the seedlings from late February to April, when weather conditions are favourable for rapid growth. The plants reach a height of about two feet before the cold weather retards growth, and the first crop of fruit is then set relatively low on the stem. In the tropics, where the seed is sown direct in the field, planting takes place in February and March.

TRANSPLANTING.

Seedlings are ready for transplanting when they are 4-6 inches in height. The seedbeds are heavily watered before the seedlings are moved and only sufficient plants should be lifted at one time as can be conveniently set out before wilting occurs; otherwise transplanting losses may become appreciable. The danger of losses at transplanting is least when seedlings are raised in individual containers.

Seedlings should be planted at the same depth as they were growing in the seedbed and the roots should be well spaced before the soil is finally pressed into position. The leaves may also be trimmed to reduce transpiration until the root system is again functioning. If two or three showery, cloudy days follow transplanting shading should not be necessary. If, however, the weather is hot and dry, each plant will require shading on the northern side either with a small board pushed in the soil at the side and leaning towards the plant or with a small leafy tree branch. Four seedlings are usually planted at each "hill" position.

Potted seedlings do not need shading.

FIELD POSITIONS.

If the papaw plantation is located on sloping ground, provision must be made for any necessary surface drains. Where the topography is rugged and implements cannot be used for land preparation, each tree position must be forked or mattocked about four weeks prior to planting. Compost may be dug into each "hill", and in the less fertile soils it is advantageous to add 4 oz. of a complete fertilizer such as 8/10.5/5, which is high in phosphoric acid. Two weeks after the seedlings are transplanted, a 2 oz. dressing of sulphate of ammonia per hill will promote vigorous growth.

Spacing distances in the plantation range from 6 ft. x 6 ft. to 12 ft. x 12 ft. On virgin rain-forest land, the trees grow very tall if they are planted close together and the wider spacings are preferred. An 8 ft. x 8 ft. spacing is, however, suitable for the average plantation, although an 8 ft. x 10 ft. spacing is probably better where vehicles can be used in harvesting operations.

Spacing the plants at 2½–3 feet intervals in the row is becoming increasingly popular in plantations on level ground (Plate 5). The surplus plants are thinned to the required final spacing when flowering takes place and the sex of the trees can be determined.

SOIL AND FERTILIZER REQUIREMENTS.

In Queensland, papaw plantations are established on virgin land which has been recently cleared of timber or on land which has grown pineapples, bananas or other crops for several years. These soils vary

Plate 5.

Young Papaw Plantation at Sunnybank. The plants will later be thinned to an 8 ft. spacing in the row.

considerably in both structure and fertility, but provided they are not subject to frost and natural drainage is good, most of them are quite suitable for the papaw crop.

Where soil fertility is high, good yields of high-quality fruit have been obtained without the use of fertilizers. More typically, however, plantations are established on soils of low or medium fertility in which plant nutrients have been lost by continuous cropping, erosion and leaching.

The papaw is a gross nitrogen feeder, and as this nutrient is rapidly leached from coastal soils, applications of a water-soluble fertilizer with a high nitrogen content produce a marked improvement in growth. The need for additional nitrogen is apparent when growth is slow and the leaves have a pale-green colour. Phosphorus deficiency is also encountered in papaw plantations on the coast, the main symptom being dark-green foliage in which the veins of the leaves and the leaf stalks are a reddish-purple colour.

Regular applications of fertilizer are therefore necessary on most soils. Good results are usually obtained from the use of an 8/10.5/5 or similar mixture applied at the following rates:—

Trees up to 3 months old—4 oz. per tree.

Trees 3-6 months old—12 oz. per tree.

Trees 6-12 months old—1 lb. per tree.

Trees 1 year old and upwards—2 lb. per tree.

Fertilizer should be applied at the above rates in September, November and again in February. A fourth and lighter application is frequently desirable in April.

In a newly established plantation, the fertilizer should be distributed in a 2 ft. band round each plant. The width of the band is increased with each successive application until the trees are one year old. From then on, the fertilizer is evenly broadcast over the surface of the plantation.

The papaw does not thrive in a very acid soil and under such conditions symptoms of phosphorus deficiency may be pronounced. When establishing a new plantation it is therefore desirable to check the acidity of the soil and if necessary broadcast lime or dolomite in sufficient quantity to bring the pH to a level of 6.0-6.5. Rates of application will vary from 1 ton to 2 tons per acre according to the initial pH and the structure of the soil.

PLANTATION MANAGEMENT.

Cultivation practices in papaw plantations vary considerably with the type of plantation. Many of these are so steep and rocky that anything other than hoe cultivation is precluded. The plant spacing adopted will also influence the method of cultivation employed. Owing to the shallow rooting habit of the plant, only skim cultivation is permissible, but weeds must be suppressed, particularly during the dry spring and early summer months when stress conditions occur. Papaws respond well to heavy mulching with dry grass or other litter. The mulch cover retards surface evaporation, helps to suppress weed growth and provides a constant supply of decomposing organic matter in the soil.

Thinning.

More plants are set out in the plantation than are required in the final stand. In southern Queensland, the surplus is thinned out after flowering takes place in such a way that the final stand contains about one male tree to every nine female trees. In the tropics, where hermaphrodite trees are more common, the plantation contains a mixture of hermaphrodite, female and male trees, and only a small proportion of males is needed for effective pollination.

Instead of removing the unwanted plants, it is good practice to lop off surplus male trees 1 foot above ground level and surplus female trees 2 feet above the ground. Should the selected tree collapse, a sucker from one of the lopped trees can then be trained to replace it. If, however, the selected tree makes normal growth and bears a satisfactory plant crop, the adjacent lopped trees are cut back to the ground.

Branching.

Branching (Plate 6) commonly occurs in the papaw tree. Some trees tend to branch more than others, even in the absence of any injury to the growing point. Branching trees usually produce smaller fruit than single-stemmed trees and the branches frequently collapse when they are carrying fruit. The branching character is generally undesirable except in strains which are naturally vigorous, as the limbs must be supported by props.

Cutting Back.

Aged trees which are still healthy can be temporarily rejuvenated by cutting them back to about 2 feet above the ground where the stem is solid. This practice may also be adopted in younger plantations where the trees have grown too tall for convenient harvesting. If the stem is cut, buds develop from the stump; two or more of the more

Plate 6.

Branched Papaw Plant. Branching takes place when the primary growing point is injured.

vigorous shoots are allowed to grow, the balance being suppressed. The lopping should be done in early spring and the cut surface of the stem should be covered with a tin to prevent cracking and subsequent decay.

FRUIT SET AND HARVESTING.

During the principal flowering period from November to late January, each tree produces approximately four flowers per week and the average setting is about 60%. During February and April, when protracted wet weather tends to interfere with natural pollination, the set is usually much lower.

The period of fruit development varies from four to nine months. The early winter crop maturing in May and June is produced by flowers borne in the previous November and December, whereas the spring crop harvested in August and September is produced by late summer flowers.

In a plant crop, about 30 fruits per tree would be harvested with an average weight of approximately 3 lb. Yields of this order are equivalent to slightly more than 3 bushels per tree.

In southern Queensland, some fruit ripens throughout most of the year but there are two main harvesting periods—April to June and September to November. In tropical districts, the main harvesting periods are longer.

For local markets, the fruit is harvested in the firm-ripe stage when the first tinge of yellow colour appears at the base and the fruit can be expected to become fully ripe in four or five days. For export to southern States, the fruit should be picked at an earlier stage. The external colour of the fruit varies according to seasonal conditions, the variety grown and the requirements of the buyer, but generally the fruit should be harvested at an earlier stage in summer than in winter.

Care must be exercised in harvesting the fruit, as they bruise easily in the firm-ripe stage. The papaw should be cut and not pulled from the tree and the fruit stalk should be severed close to the stem; otherwise immature fruit remaining on the tree may be damaged by protruding stubs. The short stalk should be trimmed from the fruit before packing.

A milky latex exudes from the broken rind of immature papaws. This latex irritates the skin, and rubber gloves and an apron should be worn if fruit is being handled for long periods.

HAND POLLINATION.

Hand pollination can be practised in a plantation of dioecious papaws to improve the fruit set when conditions are not favourable for natural pollination, and also in selected parent plants which are to be used as sources of seed for future plantings (Plates 7 and 8).

To Improve Fruit Setting.

In central and southern Queensland, defective pollination results in an irregular setting of fruit or undersized, seedless, and sometimes misshapen fruits. The phenomenon is usually associated with prolonged wet weather during the flowering period.

Male trees shed their pollen during the late bud stage before the petals open. It is therefore necessary to test the late-stage bud for free pollen by folding back the petals and tapping the bud with the finger. The operator collects a sufficient number of suitable late-stage male flower buds to complete pollinations in hand. Where male trees are plentiful, whole branches of flowers may be broken off and the buds plucked as required. The unfurled petals of the flower bud are broken off and the remaining portion is used as a brush to dust pollen lightly over the stigma lobes of the female flower. When the stigma lobes begin to wither and turn brown, further pollination is of no value.

In commercial plantations, hand pollination in the first flowering season should be carried out at intervals of about three to four days. With semi-dwarf strains the operation can be continued through the second flowering.

Controlled Hand Pollination.

In order to maintain a pure variety or strain of papaw, pollination must be carried out in selected plants under controlled conditions.

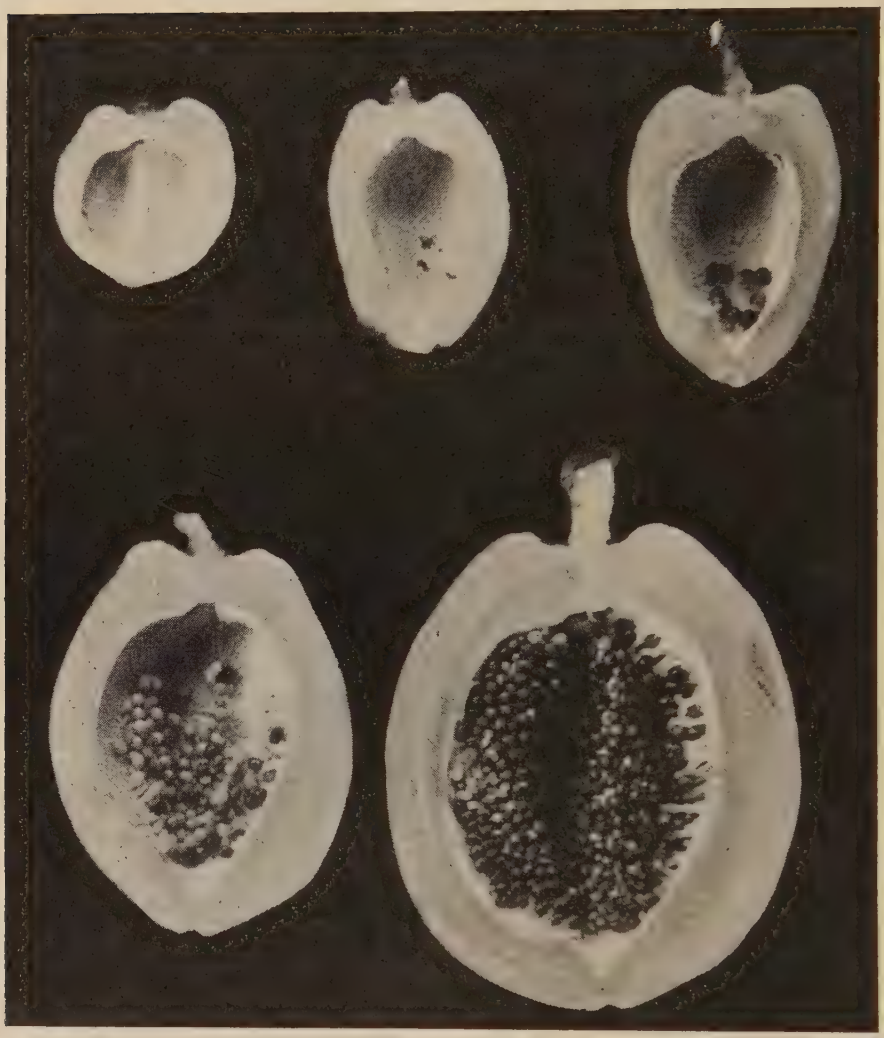


Plate 7.

Fruit Size and Pollination. The amount of seed indicates the degree of effective pollination and is correlated with both the size and the shape of the fruit.

In dioecious types, flower buds on the female tree are covered with 4 in. x 3 in. transparent paper bags a day or two before they open. All subsidiary flowers on the principal flower stalk are first removed, and the bag is slipped over the large apical bud and clipped tightly on to the flower stalk with a paper clip or fastener so as to exclude foreign pollen. When the flower opens, the bag is temporarily removed, pollen from late-stage buds of the selected male tree of the same strain is dusted on to the stigma of the female flower, and the bag is again placed in position to cover the flower. The transfer of pollen is made as quickly as possible.

The pollinated flower is appropriately labelled, with the male and female parentage recorded on the label. Commercial cardboard tags dipped in hot paraffin wax after marking with waterproof ink have been found useful for this purpose. The loop of the tag is slipped over the pollinated flower and held on the flower stalk. Seven days after pollination, the paper bag is removed.

A

B

C

Plate 8.

Papaw Pollination. A, Light crop of uneven shaped fruit in a plant which received insufficient pollen. B, An even crop in a plant subjected to good natural pollination. C, Large rounded fruit in hand-pollinated papaws in the variety Bettina.

Each hand-pollinated flower should produce a fruit with from 500 to 1,000 seeds. The number of flowers treated should be three or four times the number of fruits required to give sufficient seed for the following season after allowing for incidental losses.

The proportions of the sexes in the progeny of any particular mating depends on the characteristics of the parents. The several possible crosses segregate as follows:—

Parentage.	Progeny Ratio.		
	Female.	Male.	Hermaphrodite.
Female x Male	1	1	0
Female x Hermaphrodite ..	1	0	1
Hermaphrodite x Male	1	1	1
Hermaphrodite x Hermaphrodite	1	0	2

HELPING FARMERS PREPARE FOR IRRIGATION.

With the object of assisting and encouraging farmers to increase plantings of irrigated pastures and lucerne under the border system of irrigation, the Department of Agriculture and Stock has built a number of relatively inexpensive implements for grading and other irrigation construction work. They will be used by farmers to prepare their land.

This was announced by the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.), who said the grading of land might suggest that heavy machinery, such as road graders, was required. Though these machines do effective work, they are not readily available, and hire charges, which range from £2 10s. an hour upwards, restrict their general use.

However, there are a number of implements which give an effective performance that can be constructed on the farm. These types of equipment have been built by the Department.

The implements are a Johns leveller for grading and smoothing the land to a uniform gradient so that an even, well-distributed, controlled flow of water can be made; a crowder for forming the low mounds of earth or check banks used to confine the water in the borders being irrigated; and a delver for constructing the water channels necessary for water distribution and drainage purposes.

Units, each consisting of these three implements, have now been assigned to Departmental agricultural officers in districts where irrigation water is available for pasture and lucerne production. For example, units have been placed in the following areas: Beaudesert, Boonah, Esk, Brisbane, Brisbane Valley, Callide Valley, and Upper Burnett.

Plans of these implements, which are of simple design and which can easily be built on the farm, are available free of charge from the Department of Agriculture and Stock, Brisbane.

A number of land levellers and crowders have been built by individual farmers or groups of farmers in the Lower Burnett and many reports of their usefulness in preparing land for irrigation have been received.

A lucerne-grower at Theodore recently constructed a 16 ft. land leveller and has since used it for grading and smoothing 60 acres of land for his crop. Neighbouring farmers have also used this leveller for preparing lucerne land for irrigation, and all are well satisfied with its efficiency.

The Honey Flora of South-eastern Queensland.

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture), Science Branch.

(*Continued from page 33 of the July issue.*)

Grass-tree.

Botanical Name.—Several species of *Xanthorrhoea* are known as grass-tree; they are very difficult to distinguish from one another.

Other Common Name.—Blackboy.

Distinguishing Features.—The plants have a dense tuft of long, very narrow, somewhat grass-like leaves coming from the ground or from a stout trunk, and a long spike of white flowers (Plate 82).

Plate 82.

Grass-tree (Xanthorrhoea sp.). Burpengary.

Description.—Some grass-trees have a stout stem or trunk up to about 10 ft. high that is sometimes branched, or the stem may not grow above ground-level. The leaves are very numerous, long and very narrow (not more than ¼ in. wide), produced in dense tufts at the end of the trunk or branches or from an underground stem. The flowers are borne in dense spikes from a few inches up to 6 ft. or more long at the end of a long, erect, stout stalk; they are white or nearly white, about ½ in. across, with 6 narrow petals, 6 stamens and a central ovary.

Distribution.—Grass-trees are widely distributed in Australia. In south-eastern Queensland they are most common on ranges, stony or sandy forest land, and in wallum country.

Usual Flowering Time.—Spring and summer months.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Minor.

General Remarks.—Grass-trees are a source of both pollen and nectar. The honey, however, is thin, rank and unpalatable; some beekeepers report that it granulates with a smooth grain.

To beekeepers these plants are known principally for the large amounts of resin gathered for use as propolis for sealing cracks and spaces in the hives. This propolis is objectionable, as it sets hard during cold weather and makes manipulation of frames and other hive materials difficult. Furthermore, during summer it becomes sticky and is still a nuisance.

[TO BE CONTINUED.]

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Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
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SIZE OF SAMPLE

Barley	8 oz.	Oats	8 oz.
Beans	8 oz.	Peas	8 oz.
Grasses	2 oz.	Sorghum	4 oz
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Vegetable Seeds			½ oz.

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Dairy Herd Improvement Overseas.

By L. E. NICHOLS, Director of Research, Division of Dairying.

During the course of a visit overseas in 1953, I had the opportunity of examining methods of dairy herd improvement in Denmark, Holland, England and the United States of America.

The primary purpose of dairy herd improvement in these countries is to increase the producing efficiency of the milking herd. Major developments by which this is being so effectively achieved include production recording, better feeding, sire surveying with progeny testing, and artificial insemination.

Herd Recording.

A typical dairy herd improvement unit is an organisation of about 22 to 26 dairy farmers under a supervisor who determines the quantity of milk and butterfat produced by each cow in each herd, the cost of the feed used in its production, and the income returned per cow. Standards of testing and rules are reasonably uniform and follow closely the systems initiated in Denmark.

In Denmark and Holland, milk recording societies manage and supervise the work and publish the results. The schemes have been implemented on a voluntary basis, but in Holland encouragement has been offered by a levy on milk delivered to the factory. All costs are thus borne by the farmer. From the fund, the Central Milk Recording Service and Provincial Milk Recording Services are financed. The average cost per cow varies from 10s. to 15s.

In Holland, bi-monthly testing is mostly conducted; in Denmark, monthly. All cows in the herd are tested and both purebred and grade herds are tested at the same time. Return visits are made, with further check tests if necessary.

There is no supervised strip-out, and testing is conducted on the composite sample covering a 24-hour period by the Gerber method. The farmer himself is expected to weigh the milk and the supervisor checks periodically. Unique sampling devices are combined in the weigh bucket to save time. All tests are conducted for the full lactation and are reported as annual results; no correction factors are considered.

The production recording of dairy cattle in England has expanded in recent years and now over 25,000 herds covering 650,000 cows are recorded.

The cost of herd recording is approximately 15s. per cow and is shared equally by the Milk Marketing Board, the farmer and the Govern-

ment. The scheme is administered by the Milk Marketing Board.

The general principles are similar to those of the Danish scheme, but two schemes operate—one for butterfat testing, which demands a daily weighing of milk by the farmer and eight visits per year by the tester, and another for milk yield, which involves six visits per year by the tester. Most farmers weigh the milk weekly and a check weighing is made at random times.

While a 305-day lactation is chosen, with 365 days for Friesians, there is a move towards testing right out, with results to be reported annually. Culling is usually based on at least three lactation records.

Under the farmers' advisory herd recording scheme, it is proposed to get the farmer to weigh the milk and prepare the lactation curve with the assistance of Milk Board or National Agricultural Advisory Services officers. Later these data are to be included in the official schemes.

Herd improvement in America is directed by the United States Department of Agriculture's Bureau of Dairy Industry and is implemented through the State Agricultural Colleges and district associations.

Under the standard Dairy Herd Improvement Association scheme, a complete record-keeping service is provided, including feed records, identification, sire proving, feeding analysis, breeding analysis, costs and value of the product.

Under the owner-sampler records scheme, the owner takes his own samples and weighs the milk night and morning for each cow one day each month. The cost of this scheme is less than that of the standard scheme, but in both schemes the testing and computing are done by technicians in the Association's laboratories.

Herd recording costs approximately five dollars per cow, and this cost is borne wholly by the farmer. The production of all cows is reported for the first 305 days.

In the advanced registry, a breeder may enter one or more selected cows at any time for lactation records of either or both 305 or 365 days. Daily milk weights must be kept and test periods are preceded by a preliminary dry-milking.

Sire Surveys and Progeny Testing.

Because the use of good proved sires and sons of such sires is the

Plate 1.

Conserving Fodder on a Dairy Farm in Switzerland.

Plate 2.

A Dairy Pasture in South-western England.

surest and quickest way to improve the inherent producing ability of dairy herds, efforts are being made to prove all sires that are being used and to aid in disseminating and perpetuating the hereditary influence of the outstanding sires by artificial insemination.

On the Continent, progeny testing includes an evaluation of the effect of the bulls on conformation (exhibition of progeny) and on yield (progeny examinations and tests) and freedom from disease.

Examination of progeny to assess the contribution of the sires in terms of conformation is carried out on large collections of progeny from bulls of about five years old, selected according to fixed rules, and between 250 and 300 bulls are judged at such progeny shows each year.

In the progeny tests, the yields of the daughters are compared with those of the mothers in the corresponding lactation, to ascertain the bull's ability to transmit milking qualities.

As variations in feeding conditions made comparisons difficult, a new form of progeny testing called bull testing has been developed. While it is difficult to compare the yields of the daughters with those of the dams, it is possible to make the treatment of a selection of daughters from the different bulls uniform year by year. Teams of 15-20 daughters of an individual bull are sent to testing stations as first calving heifers a month or two before calving. Steaming up is practised and food consumption, milk and butterfat yield are recorded for 304 days after calving. The milk is weighed twice weekly and tested once weekly. Reports showing the average yield of each group are published for the information of breeders.

There are 18 bull-testing stations in Denmark, and in proving a sire, yields of the dam and grand-dam are compared. An objective of 550 lb. butterfat per annum is aimed at.

In England, the selection of bulls is based on dam-daughter comparisons. However, other factors taken into consideration include conformation, freedom from disease, milk production of 1,000 gallons, and a 4-4.5% test.

Progeny testing is conducted using 10 daughters, and treatment is the same as in Denmark.

In the United States, the Bureau of Dairy Industry considers a bull a proved sire when at least five of his unselected daughters have production

records which can be compared with the production records of their dams. These five daughters must be out of five different dams. The proving is usually published in the following form:—

—	Milk.	Fat.	Fat.
	Lb.	%	Lb.
Average—			
9 daughters (10 records) ..	10·783	5·0	543
5 daughters (6 records) ..	11·016	5·1	563
5 dams (9 records) ..	9·583	5·2	495
Difference ..	+ 1·433	— ·1	+ 68

The daughter average is as accurate as any proposed means of evaluating a sire's transmitting ability when—

(1) The number of daughters is adequate and both the daughters and their records are unselected.

(2) The feeding and management of the future daughters is the same as for the daughters in the proof.

(3) The future mates of the bull are of the same inheritance as the dams in the proof.

Five daughters are considered the minimum needed for proving sires when the influence of the dams can be taken into account and the daughters and dams are in the same herd.

All records are adjusted by correction factors to a mature equivalent, twice a day milking, 305-day lactation basis. Therefore, when a sire proof is published, one can consider that the influence of age, frequency of milking and length of lactation has been reasonably well eliminated. Information on feeding, disease and other factors is obtained at the place where the daughters were tested.

A standard as high as 420 lb. butterfat has been chosen in sire-proving work in the United States. In progeny testing to prove sires on first calf lactations, wide variations have been noted despite uniform feeding. It has also been found that, after 100 daughter comparisons with an A.I. bull, lactation curves tend to straighten out. In the early stages the daughters' production exceeds the dams'; later they become variable; and still later there is a decline to below that of the dam. Studies are now being based on the dam's production and seasonal effects.

Danish authorities claim that a good bull can increase production up to 270 galls. per cow. Thus, with an

Plate 3.

Fodder Conservation in Denmark.

Plate 4.

A Farming District in the North of England

average of 4,000 daughters and 18,000 lactations, a good bull could be responsible for 21.1 million gallons of milk, in comparison with 12.6 million gallons by a bad bull. Though more feed is necessary to achieve this result, the cost of the extra feed is only half that of the additional milk yield. It is claimed by the Milk Marketing Board in England that milk can only be produced at low cost if cows have the inherent capacity to produce high yields. By doubling the yield of a cow giving 480 gallons milk, the margin of profit increases fourfold.

Artificial Insemination.

Artificial insemination is practised in 75% of the herds in Denmark and in 50% of the herds in Holland. It is applied to 37% of the cows in England and 30% of those in the United States.

The expansion of artificial insemination in various countries is due largely to the small size of the dairy farms. With herds up to 25 cows, the practice is considered economical and worthwhile at 17s. to 25s. (up to 6 dollars in the U.S.A.) per insemination.

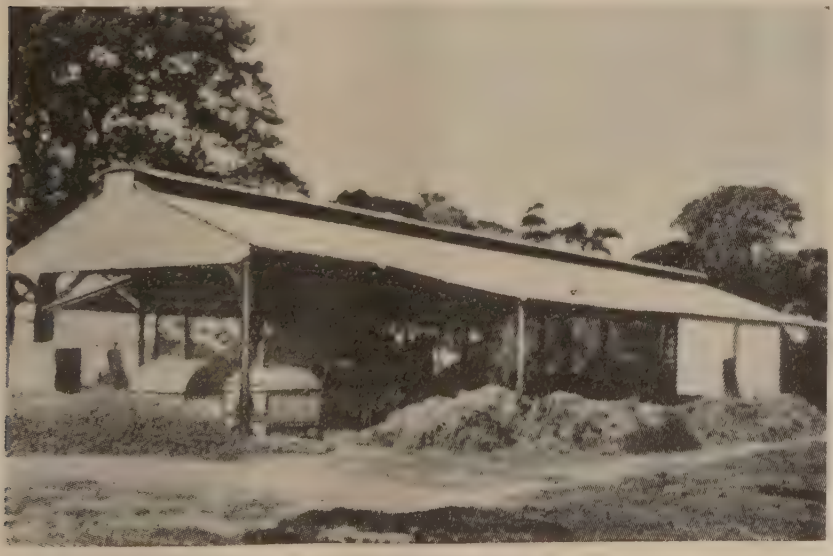

Plate 5.

A Grass Drying Centre of the Milk Marketing Board in England.

Plate 6.

The Warwickshire Artificial Insemination Centre of the Milk Marketing Board.

The development of deep-freezing techniques in England for the storage of semen promises to be revolutionary in its repercussions. This technique will permit semen to be distributed over long distances at a reasonable cost. The system could have a strong influence on the progeny testing of young bulls, as their semen could be held in deep-freeze until the lactation records of their daughters were known. It may also help overcome some problems of inbreeding, as crossbreeding of high-producing stock between countries will be facilitated.

Under Queensland conditions, the development of artificial breeding practices may present a problem. Larger farms and longer distances are not conducive to the successful operation of an A.I. scheme, nor can the inconvenience to the farmer under pastoral dairy practices be underestimated. In any case, A.I. would be less beneficial while the feeding of dairy cattle is inadequate.

Feeding Dairy Cattle.

While the feeding of concentrates to dairy cattle is generally recommended and is widely practised, no claims are made regarding the economy of the method, particularly where a manufacturing dairy economy operates, as in Denmark and Holland, where the average return for milk is about 2s. per gallon.

In Denmark, up to 17% concentrates (grain and oilcakes) are fed. The remainder is home-grown coarse fodder, with root crops, grass and green fodder predominating. It is appreciated everywhere that the fullest use must be made of home-grown fodder, and feeding as much as possible with hay, silage and pasture is advised. Some authorities favour bringing cows up to two to three gallons on home-grown fodder before feeding concentrates.

In England, where a market milk economy exists, there seems little doubt that concentrate feeding pays. Cost of production, including concentrates, is about 2s. 3d. Aust. and the average price is about 3s. 6d. For some time there was a subsidy on concentrates, and milk producers have benefited also from cheap transport and the provision of milk cans, as well as a production bonus.

Steaming-up experiments with high-producing Red Danish milk breeds have shown that it is possible to increase production from 400 lb. butterfat to 1,100 lb. Once the capacity for milk production is established, intensive feeding may be justified. A suitable daily ration includes 55-66 lb. fodder beet, 33 lb. good grass or clover silage, 11 lb. good hay and 30–40 lb. good concentrates. Concentrates are fed four times daily and roughage three times. These experiments have demonstrated the amount of good feed necessary for high production and the steps required to test a cow's capacity for milk production.

In Holland the standard ration fed to each cow with the capacity for high milk production is 16 lb. good hay, 40 lb. good silage, 2 lb. dried grass, 22 lb. fodder beet, 4 lb. dried pulp and 4 lb. concentrates. With some pasture available, grazing yields have increased to 760 gallons per cow.

A point of some significance to Queensland is that in Denmark the most favourable calving time for high-yielding cows is the autumn. Autumn calvings give their highest yields of milk during the winter months and are less bothered by the heat of summer than spring calves. In Queensland, summer heat corresponds with the best pasture growth. Better winter feeding with conserved summer fodder would thus have a twofold advantage and justify the testing of reasonably well fed cows. It is also significant that some Queensland cows are dry during the off-season and therefore on a low plane of nutrition.

Breeding Improvement.

Where milk production is of paramount importance, as in Holland, England and America, Friesian or Holstein breeds predominate. In Denmark, where greater emphasis is laid on butter production, Red Danish breeds are dominant, while Jerseys are increasing. Where inbreeding has been practised for many years and peak production seems to be in sight, crossbreeding with high-producing strains from other countries is being considered and certain breeds have already been introduced.

Plate 7.

Red Danish Cows in Denmark.

Plate 8.

Judging a Danish Red Progeny Group in Denmark.

Calf Rearing.

It was surprising to find so many countries practising the system of continuously housing calves under hygienic conditions even when weather was favourable for keeping them outside. Raised calf stalls are popular in America and ensure dry bedding at all times.

Feeding methods are similar to those operating in Australia, though experiments with antibiotics in England and America suggest the possibility of an increase in the rate of growth and better utilisation of food.

Nipple feeding of calves is favoured in America. In a number of Continental countries, however, there is a generally wider appreciation of the value of soured buttermilk and soured skim-milk for use in calf rearing.

Grass Drying.

The practice of grass drying is extending in some European countries, especially Holland, where 300 grass driers are now operating. In England, apart from a number of private installations, there are 12 operating under the supervision of the Milk Marketing Board. Despite the cost of fuel and wages, interest in the method is widening.

The technique assures a sound method of preserving the nutrients in pasture harvested at its most nutritious stage, with a protein content between 16% and 20%. At Dartington Hall, in England, ryegrass/clover pasture is not only dried but ground and pelletted and at times fortified with minerals.

The cost of the normal process for drying grass, confirmed by the Milk Marketing Board, is approximately £20 sterling per ton. The cost of installing a drying plant on the average farm is about £2,000.

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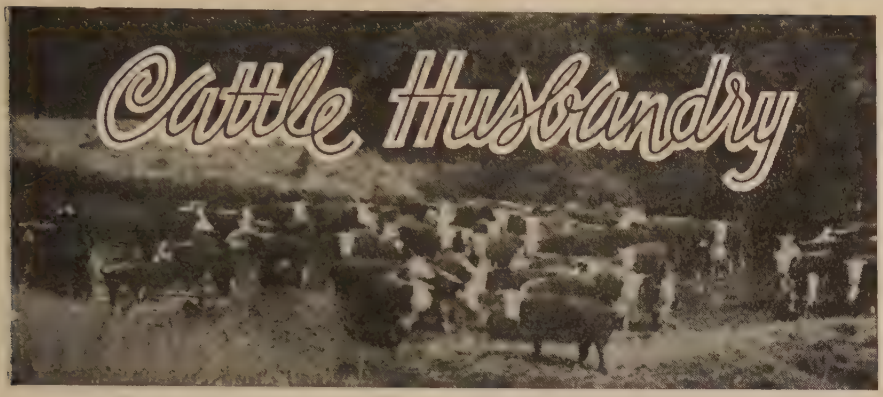

Results of Feeding Demonstrations Under the Commonwealth Dairy Industry Extension Grant.

By G. I. ALEXANDER, Cattle Husbandry Branch.

In an article in the January 1952 issue, the purpose of the feeding demonstrations was outlined. Briefly, they were designed to demonstrate the comparative efficiencies of various concentrate mixtures as aids to butterfat production when fed at different rates to milking cows.

Before these trials were commenced, it had been shown experimentally at Kameruka in New South Wales that under certain conditions economic returns could be achieved by feeding small quantities of grain and protein mixtures.

The Queensland trials were to some extent based on the New South Wales experiment and the following basic principles were followed:—

(1) The herds had to be under regular recording for butterfat production so that the yields of each cow therein would be known.

(2) Each cow was to be fed as an individual according to her production.

(3) No allowance was to be made for maintenance.

Originally three farms were used in each district for different feeding methods, with a fourth farm as a check farm. However, this did not prove satisfactory, due to the great variation between herds, even neighbouring ones, in the same district.

An attempt was also made to vary the ration of feed according to the season, as was done in some previous Australian feeding trials, but under our conditions this proved impracticable.

The farms were selected so as to give an indication of the way in which different feeding schedules operated under a wide variety of climatic and seasonal conditions, dairying practices and methods of marketing.

They were situated in the Beaudesert, Oakey, Kingaroy, Gympie, Monto and Atherton districts. All of these districts, with the exception of Beaudesert and Atherton, are mainly butter producing areas, but for convenience in rationing the Atherton district was regarded as a butter producing area. Beaudesert was the only district in which the herds were rationed on a wholemilk production basis.

After the first year, check farms were no longer used and each trial herd was divided into at least two groups of cows; some into three. On

the farms where three groups were used, one was a check group not fed any concentrate mixture at all and the other two were fed either a concentrate mixture at different rates or mixtures containing different percentages of protein.

In rationing the cattle in butter production areas, the assumption was made that the grass and other roughage available on the farm was sufficient for a cow's maintenance and for the first gallon of milk produced. In the wholemilk-production area this assumption was not made, all milk produced being taken into consideration.

For uniformity, the amount of milk produced by cows was expressed on the basis of a 4% butterfat content, except in the Beaudesert area, where a test of 3.3% was used. The latter is the requirement for the Brisbane wholemilk supply.

Bearing in mind that in the cream zone feeding a small amount of concentrates was likely to be economic, whereas a full allowance was unlikely to be, the concentrates (consisting of mixed grains of 10% crude protein) were fed at various rates, ranging from 1 lb. of concentrates for every 2 lb. of milk (4% butterfat test) over and above the first 10 lb. milk produced to 1 lb. concentrates for every 8 lb. of milk (4.0% butterfat test). This was to demonstrate the response in milk production to the various rates of feeding as well as to reveal the economics of the various levels.

One of the important considerations in a cow's production is the protein it receives from the grass. While the grass is young, there is a good protein intake by the grazing cow, but this decreases as the grass matures, flowers and seeds. This prompted the use of a number of rations containing different percentages of protein.

Grains containing approximately 10% crude protein were compared with rations containing up to 40% crude protein. The following concentrate mixtures were used:—

(1) Crushed grains (approximately 10% crude protein).

(2) Grain and linseed meal (approximately 15% crude protein).

(3) Grain, meatmeal and linseed meal (approximately 20% crude protein).

(4) Grain and meatmeal (approximately 20% crude protein).

(5) Grain and meatmeal (approximately 25% crude protein).

(6) Peanut meal (approximately 40% crude protein).

(7) Meatmeal and molasses (approximately 25% crude protein).

All rations used contained 1% salt and 1% bonemeal.

On each property cows were paired on the basis of their production capacity, age, and date of calving. Production capacity was reckoned on previous lactation records, or if none such was available, on the initial test of the then current lactation. Cows with a previous lactation of less than seven months were not included in the pairings.

The cows were fed under the supervision of a field officer. They were production recorded at monthly intervals and re-rationed as required according to their records.

All cows coming into production during the course of a demonstration were fed 2 lb. concentrates per day for four weeks prior to calving, irrespective of previous production or subsequent rate of feeding intended.

When comparing results, it was decided to group the cows according to their date of calving, those calving between April and October forming one group, and those calving between November and March the second. These two periods were chosen to approximate the two main seasons—that of poor growth, and that of good growth of pasture.

On some of the properties, the trials extended over a 3½-year period from January 1950 to June 1953. However, a number of farms were included in the demonstrations after 1950 and so results as shown are not for the full period. In a number of seasons on some farms there were insufficient pairs to provide an adequate comparison; such farms have been excluded from reference for the seasons concerned. The absence of sufficient pairs is mainly the result of seasonal calving on small farms.

TABLE 1.

MILK PRODUCTION WITH DIFFERENT RATES OF FEEDING CONCENTRATES CONSISTING OF MIXED GRAINS CONTAINING 10 PER CENT. CRUDE PROTEIN.*

Herd.	No. of Pairs of Cows.	District.	Feeding Rate of Concentrates.						
			1 Lb. to 2 Lb. Milk.	1 Lb. to 3 Lb. Milk.	1 Lb. to 4 Lb. Milk.	1 Lb. to 5 Lb. Milk.	1 Lb. to 6 Lb. Milk.	1 Lb. to 7 Lb. Milk.	1 Lb. to 8 Lb. Milk.
(a) Season: April–October, 1950.									
K	9	Oakey	..	4,289 (887)†	..	..	4,477 (510)	..	..
F	7	Monto	..	4,616 (866)	..	..	4,534 (514)	..	..
C	5	Gympie ..	..	2,577 (564)	..	..	2,863 (360)	..	..
(b) Season: April–October, 1951 (Drought Conditions).									
K	12	Oakey	..	2,705 (680)	..	..	2,548 (350)	..	..
B	11	Gympie ..	..	3,844 (1,064)	..	..	3,813 (627)	..	..
(c) Season: November 1951–April 1952 (Drought Conditions).									
O	9	Atherton ..	6,672 (2,313)	..	..	..	..	..	6,297 (620)
K	8	Oakey	3,064 (608)	..	..	..	..	2,801 (209)	..
M	5	Atherton ..	6,086 (1,848)	..	..	..	..	5,297 (516)	..
J	15	Oakey	..	..	5,408 (735)	5,325 (627)	..	..	..
(d) Season: May–October 1952.									
M	9	Atherton ..	5,972 (1,937)	..	..	..	..	5,572 (597)	..
L	10	Atherton ..	5,022 (1,614)	..	..	..	..	4,772 (498)	..
O	9	Atherton ..	6,907 (2,387)	..	..	..	..	..	7,538 (703)
J	15	Oakey	..	..	5,810 (824)	5,922 (718)	..	..	..
(e) Season: May–October 1952.									
H	14	Monto	..	..	3,915 (699)	..	..	4,140 (422)	..
F	9	Monto	..	..	6,310 (1,320)	..	..	..	6,273 (577)
E	10	Monto	..	..	5,223 (1,083)	..	..	5,310 (516)	..
G	5	Monto	..	..	5,400 (900)	5,028 (1,450)	..	..	..
C	7	Gympie ..	..	..	3,934 (1,007)	..	..	3,889 (613)	..
D	9	Gympie ..	4,317 (1,590)	..	..	..	..	4,578 (617)	..

* Milk production is given as average per cow in pounds for a 210-day lactation

† Figures in brackets represent average consumption of concentrates per cow for a seven months' lactation.

BUTTER PRODUCING AREAS.

A. Different Rates of Concentrates (Mixed Grains) Feeding.

As can be seen from Table 1, except for the drought involving the period April 1951–April 1952, there was no consistent increase in production in response to increasing rates of concentrate feeding (from 1 lb. per 8 lb. milk produced, up to 1 lb. per 2 lb.). In fact there were at times decreases in production, as for example in herds K and C for the season April–October 1950 (Table 1 (*a*)).

During the drought period (Table 1 (*b*) and (*c*), the increased production varied from approximately 250 lb. milk (herd K in Table 1 (*c*)) to 800 lb. milk (herd M in Table 1 (*c*)) per cow lactation. The concentrates consumed in effecting these increases varied from approximately 400 lb. (herd K) to 1,300 lb. (herd M). At a price of 4d. per lb. for concentrates, the cost can be reckoned as approximately 6d. per lb. milk (that is, 5s. per gallon, which is quite uneconomical).

The relation of lactation length to the various rates of concentrates feeding is shown in Table 2. On individual farms there were insufficient cows to permit an effective comparison between any two rates of feeding and the table is compiled on a State-wide basis.

TABLE 2.
LACTATION LENGTH IN RELATION TO RATE OF FEEDING.

Rate of Feeding.	No. of Lactations Considered.	Average Lactation Length (Days).
1 lb. conc./8 lb. milk ..	27	253
1 lb. conc./7 lb. milk ..	49	246
1 lb. conc./6 lb. milk ..	112	231
1 lb. conc./5 lb. milk ..	321	263
1 lb. conc./4 lb. milk ..	23	257
1 lb. conc./3 lb. milk ..	145	235
1 lb. conc./2 lb. milk ..	69	248

While there was a 32-day difference in the lactation lengths of the groups fed at the rate of 1 lb. concentrate per 6 lb. milk and 1 lb. concentrate per 5 lb. milk, most of the lactations in the former group were recorded prior to July 1952, and so included the drought period when lactations were short.

Differences of breed and strain, together with seasonal effects, so complicate the picture that all that can be said is there was no gross difference in lactation length between the seven groups.

B. Different Levels of Protein in Concentrate Mixture.

Mixtures containing different levels of protein were fed at the rate of 1 lb. per 5 lb. milk (4% butterfat) to determine whether any differences in efficiency of utilization could be demonstrated. Results are shown in Table 3.

TABLE 3.
MILK PRODUCTION WITH DIFFERENT LEVELS OF PROTEIN IN MIXTURES FED AT THE RATE OF 1 LB. PER 5 LB. MILK OF 4 PER CENT. BUTTERFAT*.

Herd.	No. of Pairs of Animals.	District.	10 Per Cent. Protein Mixture.	15 Per Cent. Protein Mixture.	20 Per Cent. Protein Mixture.
(a) Season: November 1949–April 1950.					
A	8	Gympie ..	4,071 (726)†	..	4,028 (714)
(b) Season: May–October, 1950.					
L	7	Atherton ..	3,885 (434)	..	4,579 (597)
G	5	Monto ..	3,975 (630)	..	4,412 (606)
D	9	Gympie ..	3,425 (580)	..	3,832 (695)
J	11	Oakey ..	5,987 (758)	5,436 (625)	..
(c) Season: November 1950–April 1951.					
L	10	Atherton ..	4,310 (597)	..	4,973 (697)
E	6	Monto ..	3,305 (545)	..	3,693 (600)
D	8	Gympie ..	3,088 (473)	..	3,486 (529)
A	9	Gympie ..	4,542 (852)	..	4,541 (912)
J	14	Oakey ..	4,888 (651)	4,667 (621)	..
(d) Season: April–September, 1951.					
J	9	Oakey ..	4,464 (690)	4,202 (700)	..

* Milk production is given as average per cow in pounds for a 210-day lactation.

† Figures in brackets represent average consumption of concentrates per cow for a seven months' lactation.

During the winter of 1950 (Table 3 (*b*)), the group fed a concentrate mixture containing 20% crude protein produced 8–10% more than the group fed a meal containing 10% crude protein (grain only). An increase of this order is, however, not significant, due to the size of the errors unavoidable in pairing cows, as well as to reckoning production on the basis of monthly recordings. Such errors may be as large as 15%.

It is interesting to note that while production was increased slightly in the Atherton, Monto and Gympie areas, there was no lift associated with a higher level of protein in the concentrates fed in the Oakey area. In that area cereal crops are extensively grazed in winter; hence there is not the same protein lack at that time of the year as in many other parts of the State.

During summer seasons (*a*) and (*c*) in Table 3, there was no marked difference in response in groups fed different levels of protein (10, 15 and 20% crude protein) in the concentrate mixture.

The difference during the period November 1950–April 1951 (Table 3 (*c*)) represented an increase of 8–10%. This was early in a drought and was probably due to a shortage of protein in the pastures. Later in the drought, the deficiency in the pastures deepened from one of digestible protein to one of total nutrients and the increased production from feeding concentrates fell away.

The differences between 10% and 20% crude protein were all in favour of the 20% crude protein mixture with the exception of the herd A in the Oakey area. However, the difference did not exceed 10% and so may be regarded as a significant difference.

C. Feeding versus Non-feeding.

The one occasion where there were sufficient pairs of cows in the groups in the same season to warrant examination is shown in Table 4.

TABLE 4.

FEEDING VERSUS NON-FEEDING OF CONCENTRATES ON A MONTO DISTRICT FARM. SEASON: MAY-OCTOBER, 1950.

No. of Pairs of Animals.	Group.	Feed.	Average Milk Production (210-Day Lactation).
			Lb.
10	1	Not fed concentrates..	3,408
	2	1 lb. conc. (10 per cent. C.P.)/5 lb. milk	3,679
12	1	Not fed concentrates..	3,789
	2	1 lb. conc. (20 per cent. C.P.)/5 lb. milk	4,422

The check group (not fed) appears to have two different levels of production, but this is due to different cows in this group being paired with those in the two fed groups. There were three groups of cows on this farm—one check or non-fed group, one group fed on a concentrate mixture containing 10% crude protein, and one group fed a concentrate mixture containing 20% crude protein.

The figures in the top half of the table are a comparison of the 10% crude protein group with the check group; those on the bottom half a comparison of the 20% crude protein group with the check group.

The increase in production is in excess of 10%. However, 500-600 lb. concentrates were required to effect an increase in milk production of 30-40 gallons. At the current price of 4d. a lb., the milk production was increased at a cost of 5s. to 5s. 6d. per gallon, which is uneconomical.

WHOLEMILK (BEAUDESERT) AREA.

In this area, as stated previously, cows were fed concentrates for *all* the milk that they produced, corrected to 3.3% butterfat test. A quota system operates in the area whereby the market for wholemilk in the summer is directly proportionate to winter

production. As a result, farmers endeavour to produce as much milk as possible during the winter in order to increase their summer quota. To this end they might for a short time in the winter feed at what would otherwise be uneconomic levels.

A. Different Rates of Concentrates (Mixed Grains) Feeding.

The rates of feeding compared were 1 lb. concentrates per 3, 5, 6, and 10 lb. of milk produced. There was no significant difference between the four rates during the months April to October. During the summer months there were insufficient cows calving to give enough pairs for comparative purposes. This was due largely to the emphasis placed on winter production of milk to meet market requirements.

TABLE 5.

MILK PRODUCTION WITH DIFFERENT RATES OF CONCENTRATES (MIXED GRAINS—10 PER CENT. C.P.) FEEDING.

Herd.	Season.	Rate of Feeding Concentrates. Rate of Feeding (10 Per Cent. C.P.)	Average Milk Production for 210 Days.
			Lb.
R	April-Oct., 1952	1 lb. conc./6 lb. milk	5,496 (809)†
		1 lb. conc./3 lb. milk	5,106 (153)
S	April-Oct., 1950	1 lb. conc./10 lb. milk	4,265 (527)
		1 lb. conc./5 lb. milk	4,842 (1,128)

† Figures in brackets represent average consumption of concentrates per cow.

Herds R and S were fed crushed grains at two rates. So far as the remainder of the rations was concerned, herd R was fed solely on pasture while herd S was fed a considerable amount of roughage in addition to pasture. The response to concentrates feeding was better, proportionately, in herd S than in herd R.

TABLE 6.

EFFECT OF USING DIFFERENT LEVELS OF PROTEIN IN THE CONCENTRATES MIXTURE FED*

Herd.	Season.	Group. 10 Per Cent. Crude Protein (1½ lb./10 lb. Milk).	Group. 20 Per Cent. Crude Protein (1½ lb./10 lb. Milk).
		Lb.	Lb.
Q	April-Oct. 1950	4,033 (464)	4,539 (561)†
S	April-Oct. 1951	3,388 (693)	3,263 (681)

Herd.	Season.	Group. 15 Per Cent. Crude Protein (1 lb./5 lb. Milk).	Group. 20 Per Cent. Crude Protein (1 lb./5 lb. Milk).
		Lb.	Lb.
Q	April-Oct. 1952	5,064 (979)	5,251 (1,049)
S	April-Oct. 1952	4,595 (815)	5,295 (1,000)

* Milk production is given as average per cow for a 210-day lactation.

† Figures in brackets represent average consumption of concentrates per cow.

B. Various Levels of Protein in the Concentrates Mixture.

From Table 6 it may be seen that in herd Q during the months April–October 1950 there was a lift in production associated with the use of 20% protein in the concentrates supplement, as compared with 10%. However, in the following year (April–October 1951), when a drought was in progress, there was no such lift associated with the feeding of a higher percentage of protein. On the contrary there was a slightly lower overall level of production.

Table 6 also shows a comparison between groups of cows fed concentrates mixtures containing 15% and 20% protein.

Herd Q gave a moderate increase in production from feeding the higher protein mixture, while herd S gave quite a substantial increase. Since herd S is a pasture farm and Q

utilises roughages to a considerable extent, it may be that where there is an adequate supply of roughage, it is not so important that the concentrates mixture contain a high level of protein as when there is insufficient roughage.

DISCUSSION AND CONCLUSIONS.

The results achieved in the demonstrations indicate that there is a very variable response in milk production by cows to concentrates feeding. This may be ascribed to many factors among which three are considered of particular importance:—

(1) Productive capacity of the cows.

(2) Accuracy of the methods used in determining the cows' production.

(3) The quality and quantity of roughage available to the cow.

(1) Productive Capacity of the Cow.

Every cow inherits a certain productive capacity. Certain breeds of cows have higher inherent productive capacities than other breeds. Similarly, within the breeds, there is a great variation in productive capacities of strains or families of cows. This is further accentuated when dealing with cross-breeds. In these demonstrations, concentrates were almost certainly fed to some cows physically incapable of giving an adequate response in terms of milk to the increased food intake.

(2) Accuracy of Techniques Used.

The method used in determining the production of the cows was that of monthly herd recording. An analysis of the results has shown that more frequent recording is necessary if it is desired to attach significance to variations in production of the order of 10%. Such a variation was often as much as followed the feeding of concentrates.

(3) Roughage Available to the Cow.

A milking cow requires food firstly for maintenance, and secondly for production. There is competition under the two headings for whatever food is available. Obviously, therefore, sufficient for maintenance *and* some small amount of production must first be available to a cow before any supplementary feeding aimed at increasing production can have its full effect.

Before feeding his dairy herd costly concentrates in an endeavour to increase production, a farmer should ensure that the cows are already receiving ample fodder for maintenance requirements. The maintenance diet may—and in most cases should—consist entirely of roughage. This is a term applied to feeds that are high in fibre, bulky and of comparatively low energy value. Such feeds are grass, hay, green crops and silage.

Buying good quality roughage may be a costly business, but if home-grown, then roughage is considerably cheaper than purchased concentrates. Grass, of course, is the cheapest roughage of all.

Apart from considerations of cost, roughage is essential for efficient working of the cow's digestive system. The feeding demonstrations have been of great value in drawing attention to the importance of good roughage in the feeding of dairy cows. A generous ration of such roughage seems essential to successful feeding; and if the economics are to be ensured, as much as possible of the roughage must be home-grown. Some at least should be conserved as hay or silage.

It may well be that in the feeding demonstrations reviewed, insufficient good roughage to constitute an adequate maintenance ration was often an all-important factor.

That aspect of the matter at all events requires to be carefully explored in future feeding trials.

Until this is done, the conclusion to be drawn from the demonstrations—that concentrates feeding under present conditions in Queensland is for the most part uneconomic—should be accepted with some reserve.

The demonstrations have provided us with a great deal of basic information that was previously lacking; the fact that doubts have been raised about the economics of concentrates feeding should not be allowed to conceal that. Should at any time in the future the price of milk in relation to grain change so as to make the economics of concentrates feeding less of a hazard than at present, this basic information will be available for early and profitable application.

Certain indirect benefits from feeding concentrates were noted by farmers during the course of the demonstrations. These included:—

(1) Improved temperament of cows whilst in the milking shed—cows were more contented and easier to handle.

(2) Stronger calves born to fed cows—calves also easier to rear.

(3) Slightly increased carrying capacity of farms.

All three are difficult to measure, but the author agrees that they operated to some extent.

IMPROVING COTTON VARIETIES.

Cotton improvement work for the 1953-54 season has just been completed by plant breeders of the Department of Agriculture and Stock, who have selected material for next season's plantings. The selections were made from trial plots grown at the Biloela Regional Experiment Station and by farmer co-operators in other districts.

This season's work included a continuation of the improvement of the main commercial varieties and refinement of the jassid-resistant back cross of Miller, suitable strains of which are available for commercial plantings.

Seed which will be used in further investigations was selected from a plot of Empire, a newly introduced variety which has shown promise as a high-yielding cotton with suitable fibre characteristics. It has performed well under both irrigation and dry farming conditions, and the plant type appears suitable for mechanical harvesting.

Small multiplication plots of newly introduced cottons were examined, but further testing will be necessary before their value can be assessed.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) explained that his Department was responsible for developing seed supplies of suitable varieties of cotton for the different districts of the State.

Cotton is an easily cross-pollinated plant, and when growing the crop for seed rigid precautions must be taken to reduce all chances of contamination between varieties. Fields which are being used to produce seed for planting purposes are isolated by at least half-a-mile from other cotton, and the crop must not be planted in soil where cotton of another variety was grown during the previous season.

The greatest care must be taken at the ginnery to prevent the seed of different varieties from becoming mixed. To simplify this, only the minimum number of varieties necessary to meet all requirements is maintained. At the same time, new varieties are continually being tested, particularly for their suitability for mechanical harvesting.

Unfortunately, any variety of cotton deteriorates rather rapidly unless the purity of the type is maintained by carefully-conducted breeding operations, which involve a system of regular replacement with pure seed.

ANIMAL HEALTH

Acetonaemia of Dairy Cattle.

By B. PARKINSON, Veterinary Officer.

Acetonaemia (or ketosis as it is sometimes known), a disease affecting dairy cattle, is not widely encountered in Queensland, but it can cause considerable economic loss if not recognised and treated.

It belongs in the category known as metabolic diseases—those diseases of non-infectious origin (occurring commonly around calving time) and associated with upsets in some of the essential nutrient factors in the blood stream. Other metabolic diseases commonly encountered are milk fever (blood calcium affected) and lactation tetany, oat tetany or grass tetany (blood magnesium affected).

In acetonaemia the metabolism (that is, breakdown of complex compounds in the food to simpler substances which can be utilized by the body for energy, etc.) of carbohydrates (sugars, starches, fibres) is impaired and the blood sugar level is affected.

OCCURRENCE.

The disease occurs in high producing dairy cows of all ages, although third calf cows and over are most commonly affected. Most cases occur within a few weeks of calving, but cows later in lactation can be affected, particularly if heavy milkers.

Cows which are handfed appear more prone to acetonaemia, but pasture fed cattle are also commonly affected. Low nutrition in the last few weeks of pregnancy appears to be a predisposing cause.

CAUSE.

The exact mechanism which brings about acetonaemia remains uncertain. Predisposing causes, such as the beginning of a heavy lactation, low nutritional intake, sudden change from good to poor feed, or travelling, bring about a derangement in the cow's system, whereby she fails to make correct use of carbohydrates.

This results in a shortage of blood sugar in the animal and the body then draws upon its own fat reserves in an attempt to replenish the blood sugar level. This breakdown of fat produces harmful products (known as acetone or ketone bodies) which appear in the blood stream in excessive quantities, thus producing the condition of acetonaemia with its resultant symptoms.

SYMPTOMS.

A type of acetonaemia is often met with in both hand and pasture fed cattle in which the level of acetone bodies in the blood is raised, but not to a level sufficiently high to produce symptoms. In these cases the breath generally has a sweetish chloroform-like smell (of acetone).

When obvious signs of acetonaemia are present there is a marked loss of appetite and milk secretion rapidly falls. The cow generally appears sick and depressed, stands about in a fixed attitude and shows no interest in its surroundings. At times, other confusing symptoms occur, when the condition may be subdivided into three types.

(1) Digestive Type.

This is probably the most common type. It occurs usually within 2–6 weeks following calving. The onset is usually sudden with typical symptoms as described above. Loss of condition is very rapid. Digestive disturbance is indicated by loss of appetite or depraved appetite, cessation of normal bowel movements, arching of the back, and constipation in most cases, although diarrhoea is occasionally seen. Some cases may show partial blindness and a staggering gait and may eventually go down and be unable to rise. These is no increase in body temperature, and breathing is normal.

(2) Milk Fever Type.

Here, the condition occurs at the same time as milk fever and usually is only recognised when such cases fail to respond to calcium borogluconate treatment. As acetone bodies are present, they may be detected by the odour of the breath. Additional symptoms to those of milk fever are wild expression of the eyes, plunging about while down and increased sensitivity as noticed by muscle twitching, especially twitching of the eyelids. Usually only adult cows are affected.

(3) Nervous Type.

This is probably the rarest type. The symptoms of digestive acetonaemia are seen to a more severe degree, accompanied by marked excitability with wild reckless plunging and apparent blindness. The animal appears demented, walks in circles, champs the jaws, salivates profusely, stamps the feet and may stand with the head against obstacles or lick and bite at objects. In the final stages the animals go down and cannot rise.

POST-MORTEM APPEARANCES.

There are no clear-cut post-mortem findings which distinguish the disease, as no changes in body organs or tissues are associated with it.

COURSE.

The course varies with the severity of the symptoms. Most digestive cases recover naturally within a few weeks, but some may progress to more serious nervous forms in which a high mortality rate can be expected if no treatment is carried out.

Usually response to treatment is good, with return to normal in a few days, but occasionally persistent cases are seen which do not readily respond and in which emaciation and low production persist. The result of treatment is less favourable in cases where treatment is not commenced until very late.

DIAGNOSIS.

Diagnosis is based mainly on symptoms as set out above. However, a chemical test of the milk or urine may be used. Acetone bodies from the blood stream are being excreted in the urine and milk in large amounts, and the test is based upon their detection in these fluids in quantities greater than normal.

Other diseases with which the various types of acetonaemia may be confused are listed as follows:—

(1) Digestive Type.

(*a*) Simple indigestion, due to overeating. Acetonaemia is suspected, especially in high producing cows within two months after calving, if failure to respond to treatment for indigestion occurs.

(*b*) Traumatic gastritis (wire, nail or some similar object penetrating stomach wall). Pain on pressure over the affected area, fixed stance and painful breathing may be noticed. However, acetonaemia frequently occurs in association with traumatic gastritis and the greatest difficulty may occur in diagnosing the primary condition.

(2) Milk Fever Type.

This may be confused with milk fever, but nervous symptoms also occur and there is no response to

calcium treatment alone. The use of combined calcium, magnesium and dextrose preparations, now on the market and available to farmers, for milk fever treatment has probably helped to mask the incidence of this type of acetonaemia; the opportunity of determining whether the animal under treatment will respond to treatment with calcium alone is lost.

(3) Nervous Type.

(*a*) Lactation tetany, etc. This occurs on lush pastures or young cereal crops, but clinical symptoms may appear similar. Response is obtained to magnesium injection.

(*b*) Meningitis or encephalitis. Usually there is no association with calving time and no acetone is present on test. A rise in body temperature is always present in acute cases.

(*c*) Lead poisoning, as an acute case, can be confused with this type of acetonaemia.

TREATMENT.

Specific treatment over a large number of years has been aimed at correcting the shortage of sugar in the blood stream by the administration of glucose or dextrose as an injection into the jugular vein or under the skin. The quantity used is ¾–1 pint of 40% solution. Injections may need to be repeated daily for sometimes as long as seven days.

The rapid response to treatment as seen in typical milk fever cases is not to be expected with acetonaemia. It may be a day or two before noticeable improvement is seen and repeated injections may be necessary to forestall a relapse.

A home remedy often successful is 2–3 pints of molasses given as a drench in two divided doses a day for several days. Molasses may also be used in conjunction with glucose injection, but care in its use should be taken in order not to produce scouring; its use should cease if scouring occurs.

If marked nervous symptoms are present, 1–2 oz. of chloral hydrate as a drench with a pint each of warm water and molasses should be given to combat the excitement, and continued daily till it ceases.

Recently the use of such drugs as cortisone, A.C.T.H. and deoxycortone acetate have come into favour for treatment of acetonaemia. They appear to be more favourable for treatment of chronic or relapsing cases in which glucose injections are not proving satisfactory. These drugs are available only to veterinary surgeons and must be used only under veterinary guidance. However, they are relatively expensive to use as a routine treatment, but would be well worth while using on a valuable cow. Other drugs now being used for treatment, glycerol and propylene glycol, given as a drench are also reported to be giving satisfactory results.

A SPECIAL RADIO SERVICE FOR FARMERS

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The COUNTRY HOUR, a special service for farmers, is broadcast DAILY through the National and Regional Stations from 12 to 1.

Brucellosis-Tested Swine Herds.

A herd listed by the Department as " brucellosis tested " is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found A semi-annual or annual re-test of the herd, as determined by the Director, is required.

TESTED HERDS (As at 21st July, 1954).

Berkshire.

S. Cochrane, " Stanroy " Stud, Felton
G. Handley, " Handleigh " Stud, Murphy's Creek
J. L. Handley, " Meadow Vale " Stud, Lockyer
R. G. Koplick, " Melan Terez" Stud, Rochedale
O'Brien and Hickey, " Kildurham " Stud, Jandowae East
E. Pukallus, " Plainby " Stud, Crow's Nest
G. C. Traves, " Wynwood " Stud, Oakey
E. Tumbridge, " Bidwell " Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, " Kennington Stud, Underwood Road, Eight Mile Plains
H.M. State Farm, " Palen " Stud, Palen Creek
A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
H. H. Sellars, " Tabooba " Stud, Beaudesert
D. T. Law, " Rossvill " Stud, Trouts road, Aspley
R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, " Kenmore " Stud, Cambooya
H. L. Stark ," Florida," Kalbar
J. H. N. Stoodley, " Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, " Bardell," Goovigen
R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
L. Puschmann, " Tayfeld " Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
W. F. Ruhle, " Felbar " Stud, Kalbar
C. E. Edwards, " Spring Valley " Stud, Kingaroy
G. J. McLennan, " Murcott " Stud, Willowvale
H. M. Wyatte, " Deepwater " Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, " Redvilla " Stud, Kingaroy
R. J. Webber, " Webberberry " Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View " Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, " Myola " Stud, Jimbour
Q.A.H.S. and College, Lawes

Large White.

H. J. Franke and Sons, " Delvue " Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, " Highfields," Murgon
K. B. Jones, " Cefn " Stud, Pilton
R. G. Koplick " Melan Terez " Stud, Rochedale
R. Postle, " Yarralla " Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, " Dorne " Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, " Thistleton " Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, " Laurestonvale " Stud, Murgon
V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
S. T. Fowler, " Kenstan " Stud, Pittsworth
M. D. Power, "Ballinasloe" Stud, Swan Creek, via Warwick
H. L. Larsen, " Oakway," Kingaroy
C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
Mrs. I. G. Utting, " White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, " Bellwood " Stud, *via* Pomona
O. J. Horton, " Manneum Brae " Stud, Manneum Kingaroy
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney, "Talgai " Stud, Clifton
F. K. Wright, Narangba, N. C. Line
O. B. Vidler Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes

Tamworth.

S. Kanowski, " Miecho " Stud, Pinelands
N. R. Potter, " Actonvale " Stud, Wellcamp
D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
A. C. Fletcher, " Myola " Stud, Jimbour
Salvation Army Home for Boys, " Canaan " Stud, Riverview
A. J. Surman, " Namrus " Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry Road, Beaudesert
T. A. Stephen, " Withcott," Helidon
W. F. Kajewski, " Glenroy " Stud, Glencoe
A. A. Herbst, " Hillbanside " Stud, Bahr Scrub *via* Beenleigh
R. G. Koplick, " Melan Terez " Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, " Debreczen " Stud, Kinleymore *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
P. V. Campbell, " Lawn Hill " Stud, Lamington
H. J. Armstrong, Alhambra," Crownthorpe, Murgon
Q.A.H.S. and College, Lawes

Wessex Saddleback.

W. S. Douglas, " Greylight " Stud, Goombungee
D. Kay and P. Hunting, " Kazan " Stud, Goodna
J. Gleeson, " Iona Vale " Stud, Kuraby
C. R. Smith, " Belton Park " Stud, Nara
H. H. Sellars, " Tabooba " Stud, Beaudesert
H. Thomas, " Eurara " Stud, Beaudesert
D. T. Law, " Rossvill " Stud, Trout road, Aspley
J. B. Dunlop, " Kurrawyn " Stud, Acacia road, Kuraby
A. Curd, " Kilrock " Stud, Box 35, Jandowae
F. K. Wright, Narangba, N. C. Line
C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
R. A. Collings, " Rutholme " Stud, Waterford
M. Nielsen, " Cressbrook " Stud, Goomburra
G. J. Cooper, " Cedar Glen " Stud, Yarraman
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
A. H. Groves, " Kinvara " Stud, Ingleside, West Burleigh
J. E. Heath, "Springlea " Stud, Murgon
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank

British Large Black.

W. F. Ruhle, "Felbar " Stud, Kalbar
H. W. Naumann, " Parkdale " Stud, Kalbar

The Value of Maize in Poultry Feeding.

By F. N. J. MILNE, Husbandry Officer, Poultry Branch.

The poultry industry in Queensland is concentrated reasonably close to cities on the coastal fringe from Brisbane to Cairns. Poultry farmers in southern Queensland, being much closer to the wheat-growing areas of the State, haven't the increased costs of long haulages of wheat, bran and pollard with the chances of delays and shortages with which farmers in more distant parts are faced.

To encourage the greater use of maize in poultry feeding in maize-growing districts, maize-feeding experiments were carried out with chickens, growing stock, pullets and second-year hens at the Kairi Regional Experiment Station, on the Atherton Tableland, from 1948 to 1951.

There has been and still is a feeling among a number of poultry farmers that some maize in a ration is very desirable in winter time because of its "heating" effect on birds, but that it should never be fed during the summer months. There is no real basis for this prejudice, which possibly arises from the fact that maize has the highest digestible carbohydrate value of any grain.

At the Kairi Regional Experiment Station, mashes containing from 50% to 70% maizemeal have been fed to groups of laying pullets for the past five years during the height of summer, but not a bird has died from heat apoplexy.

Maize is the most important grain crop of American agriculture, for more land is planted with its seed and more farmers raise it than any other crop. As a result it is the most widely used single grain in poultry feeding. Surely this fact, added to our observations at Kairi, should clear any doubts you may have, particularly if you live in or close to a maize-growing area, as to its detrimental "heating" effect.

CAN MAIZE BE FED ALONE?

No grain, whether it be wheat, maize or sorghum, is a complete feed for poultry. These grains are rich in energy-producing carbohydrates but they lack the protein, some vitamins and minerals so essential for growth, production and hatchability. Feed maize, or the other grains mentioned, in conjunction with mashes supplying those nutrients in which the grains are deficient and you have a "balanced" ration.

NUTRITIONAL VALUE OF MAIZE.

As has already been stated, maize is a very excellent source of carbohydrates—the "fuel" for the maintenance of both heat and life. Yellow maize has the highest vitamin A content of all grains, but even if the birds were fed maize alone it would barely supply sufficient vitamin A to satisfy their requirements. It has a lower protein value (about 9%) than wheat (about 12%) and the protein of maize, which is called "zein", is not a particularly valuable body-building protein.

Of all grains it has the lowest manganese content. The feeding of 50% maizemeal in an all-mash chick starter ration could produce a leg weakness known as perosis due to a manganese deficiency, unless a supplement such as manganese sulphate was added. It will be noted in the section dealing with the experiments that all mashes, whether they contained 30% or 70% maizemeal, contained added manganese sulphate.

CHICK REARING ON MAIZEMEAL FEEDING.

During 1948, 1949 and 1950, chick-rearing experiments were conducted at the Kairi Regional Experiment Station to determine to what extent maize could be used to replace wheat, bran and pollard transported from southern Queensland.

The rations used are set out in Table 1.

TABLE 1.

EXPERIMENTAL RATIONS.

Ingredient.	Group 1.	Group 2.	Group 3.	Group 4.	Group 5.
	%	%	%	%	%
Maizemeal	30	40	50	60	70
Wheatmeal	20	14	9	..	..
Bran	14	10	5	5	5
Pollard	18	15	11	7	..
Meatmeal	15	15	16	16	17
Linseed meal	2	3	4	5	5
Lucerne meal	1	3	5	7	3

In addition, these mashes were supplemented wih a fish-oil emulsion containing vitamins A and D_3. Because of the absence of riboflavin-rich foods (for example, buttermilk powder, whey powder and livermeal), synthetic riboflavin was added to all rations. Manganese sulphate was also incorporated in all mashes. Riboflavin and manganese sulphate were intimately mixed with common salt in the following proportions:—

Common salt	30 lb.
Manganese sulphate	6 oz.
Riboflavin	4 grams.

The mixture was used at the rate of 1 lb. to every 100 lb. of mash.

In 1948, unsexed Australorp day-old chickens were used, but in 1949 and 1950 only day-old Australorp pullets were brooded. In all three trials, the chicks were reared from day-old to eight weeks of age, the first four weeks being spent under kerosene-heated hover brooders. The chicks were then transferred to adjacent rearing pens.

RESULTS OF FEEDING MAIZEMEAL TO CHICKS.

The following weights were obtained at the end of seven weeks and are compared for the three years, 1948, 1949 and 1950. Final weights at the end of an 8-week period are available only for the years 1948 and 1949, as an outbreak of caecal coccidiosis in some of the pens in 1950 marred the final results of this work.

Table 2 sets out the average weight per bird at 7 weeks of age.

TABLE 2.

Average Weight of Birds (in Ounces) at Seven Weeks.

Year.	Ration Type.				
	30% Maize.	40% Maize.	50% Maize.	60% Maize.	70% Maize.
1948*	17·09	17·17	15·68	14·95	13·88
1949†	15·62	15·13	14·34	14·35	14·8
1950†	20·24	19·73	18·32	17·36	14·37

* Unsexed chickens used.

† Pullet chickens used.

WHAT CONCLUSIONS CAN BE REACHED?

From the results it appears pretty definite that there is a limit to the quantity of maizemeal which can be included in chick starter mashes. Up to 40% maizemeal seems to be quite satisfactory. When 50% (that is, half the ration) is maizemeal, growth, as indicated by weight, is poorer. It was also noticed that the feathering was poorer and slower as the maize content of the ration increased above 50%.

The addition of manganese sulphate prevented the appearance of any symptoms of perosis.

FEEDING MAIZE IN THE GROWING STAGE.

The pullet chicks used in the 1950 experiment were maintained from the beginning of the eighth week onwards in their same experimental groups until about 24 weeks of age and on the same levels of maizemeal as had been fed to them during the chick-rearing stage.

The quantity of meatmeal in the rations was lowered and slight alterations made in some of the other ingredients so as to reduce the protein content of the all-mash rations from 18% to 16%.

Table 3 sets out the weights at the beginning (8th week) and the end (24th week) of the test.

TABLE 3.

Average Weight of Birds at Various Stages of Growth.

Age.	Ration Type.				
	30% Maize.	40% Maize.	50% Maize.	60% Maize.	70% Maize.
	lb.	lb.	lb.	lb.	lb.
7 weeks	1·26	1·23	1·14	1·09	0·90
24 weeks	4·88	5·29	4·79	4·94	4·98
Average weight increase ..	3·62	4·06	3·65	3·85	4·08

Despite the fact that the weights of those chickens on 50% or more of maizemeal were very much lower than the weights of chicks on 30% or 40% maizemeal at the start of this period, these groups caught up and in some instances passed the group on the control ration (30% maize) at 24 weeks of age. From these results it would seem that as the birds mature, their ability to utilize rations containing high percentages of maize improves.

MAIZE IN LAYING RATIONS.

The Australorp pullet chicks reared in 1949 and 1950, when they were about six months of age, were the experimental stock used in two laying experiments conducted in 1950 and 1951. In addition, the 1950 pullets were culled at the end of their first year of production and a number of them retained so that their second year of production could be recorded during 1951.

In the 1950 trial, 540 Australorp pullets were divided up into six groups of 90 each, two groups being on one of three rations.

In 1951, 450 Australorp pullets were divided into 9 groups of 50 per group, three groups being fed one of the three maize rations used in the previous year.

Maizemeal was fed at three levels in the three all-mash laying rations. The complete formulae are set out in Table 4.

TABLE 4.

FORMULAE OF LAYING RATIONS.

Ingredient.	Ration No. 1. (control).	Ration No. 2.	Ration No. 3.
	lb.	lb.	lb.
Maizemeal	55	62·5	70
Bran	12	14·5	8
Pollard	15	3	..
Meat and Bone meal (55% protein) ..	10	11	12
Linseed meal	2	2	2
Lucerne meal	6	7	8

Fish-oil emulsion containing vitamins A and D_3, synthetic riboflavin and manganese sulphate were added to the mashes. Manganese sulphate was added to offset the low manganese content of maize. Both synthetic riboflavin (vitamin B_2) and manganese sulphate were intimately mixed with the common salt portion of the ration in the following proportions:—

Common salt	20 lb.
Manganese sulphate	4 oz.
Riboflavin	2 grams.

This mixture was used at the rate of 1 lb. to every 100 lb. of mash.

The respective annual productions per bird for 1950 and 1951 along with "pounds of feed to produce a dozen eggs" is set out in Table 5. No culling was carried out during the years of the tests.

TABLE 5.

Egg Production, Feeding Economy and Deaths.

Year.	—	Maizemeal in Rations.		
		55%.	62·5%.	70%.
1950 ..	Average yearly production per bird..	196·8	204·7	200·4
1951 ..	Average yearly production per bird..	201·6	206·2	193·8
1950 ..	Pounds of feed per dozen eggs ..	6·16	6·16	6·21
1951 ..	Pounds of feed per dozen eggs ..	5·82	5·82	5·91
1950 ..	Percentage of deaths	7·2	5·0	6·6
1951 ..	Percentage of deaths	8·0	6·0	7·3

These results, together with the findings on feeding of high levels of maize to birds in their second year of production, are also set out diagramatically in Fig. 1.

Fig. 1.

Egg Production at Various Levels of Maize.

Although some variation is noticeable in production between rations, the results do indicate that laying rations containing up to 70% maize will give good egg production. The number of deaths recorded was no higher in the groups fed the highest level of maize than on the lowest level used in these tests. It would seem from the "pounds of feed to produce a dozen eggs" figures, which are a measure of feed efficiency, that the 70% maize ration was not quite as efficient as the others.

EFFECT ON SECOND YEAR OF PRODUCTION.

At the end of the 1950 maize feeding production experiments with pullets, the remaining birds were culled, 360 of the best being retained for a further year. These were retained in their original pullet groups and fed the same rations as used during their pullet year.

For comparison purposes the pullet year production (that is, 1950 production) per bird per year is also set out in Table 6, as is the second year production, feed efficiency and mortality.

TABLE 6.

COMPARISON OF FIRST AND SECOND YEAR PRODUCTION AND LOSS.

	Maizemeal in Ration.		
	55% Maize.	62·5% Maize.	70% Maize.
Av. 1st year production	196·8	204·7	200·4
Av. 2nd year production	138·7	140·1	125·7
Pounds of feed per dozen eggs (1st year) ..	6·16	6·16	6·21
Pounds of feed per dozen eggs (2nd year) ..	8·0	8·27	8·83
Percentage of deaths (1st year)	7·2	5	6·6
Percentage of deaths (2nd year)	8·3	10·8	20·8

It will be seen from this table that second-year production was not as high on 70% maizemeal as that obtained with lesser amounts of maizemeal and that consequently it took more pounds of feed to produce a dozen eggs.

The number of deaths on 70% maizemeal was also higher than on any of the other rations. However, it is difficult to link this fact with the high level of maize fed, because the causes of deaths, which ranged from leucosis to egg peritonitis, could not be attributed to the high percentage of maize in the mash.

The second-year production figures obtained from this experiment do indicate the advantage of the "all-pullet" flock on farms engaged solely in egg production.

CONCLUSIONS.

(1) The maximum amount of maizemeal which should be included in all-mash chick starter rations is 40% of the ration. Once the chickens have reached eight weeks of age, the amount of maize may be increased to 70% of the ration.

(2) With laying fowls, our experiments have shown that a level as high as 70% of an all-mash laying ration will give good production.

(3) In all cases where high levels of maize are fed, it is very necessary to add manganese sulphate to a poultry ration to compensate for the low manganese content of the grain.

COUNTRY BREAKFAST SESSIONS.

The Rural Broadcasts Section of the A.B.C. is now providing regular breakfast sessions of interest to rural people from 4QY, 4AT and 4QS, Monday to Friday from 7 to 7.15.

Harry Greaves, stationed at Cairns, handles the northern programme, and Trevor Stockley conducts the southern programme from Toowoomba.

Egg Marketing—The Equalisation of Returns.

By K. C. GUYATT, Marketing Officer, Marketing Branch.

By virtue of the powers vested in it under The Primary Producers' Organisation and Marketing Acts, The South Queensland Egg Marketing Board is able to ensure, by the operation of a pool, equal returns to all growers for eggs of the same size and quality irrespective of the market local or overseas, or the manner of disposal (that is, as eggs in shell or as frozen egg pulp).

This function, known as equalisation, is of such importance as to warrant detailed exposition.

Equalisation of returns in Queensland is not as completely possible as it is in some other States. This arises from the fact that control does not extend to the whole State or to all flocks. It follows that in many areas of Queensland there is a closed market wherein local production is insufficient to meet the local demand. This also applies to the area of The Central Queensland Egg Marketing Board. Consequently, producers in these areas, as well as the owners of less than 251 birds in South-eastern Queensland who market outside the Board, enjoy the full benefits of the more remunerative local market, which incidentally is stabilised by the organised marketing body.

POSSIBLE METHODS.

To equalise payments to Board suppliers, several methods could be considered:

(*a*) Local prices could be maintained at a level approximating export prices.

(*b*) Growers could be paid (as in the case of some other primary commodities) a preliminary advance with subsequent and final payments after the end of the trading period.

(*c*) Growers could be paid actual local selling prices less selling and administrative expenses, but be required to contribute to a Fund against which losses on sales on other markets or through avenues of disposal other than eggs in shell, could be offset.

Of these methods the scheme (*c*) is adopted by Egg Boards, but before proceeding to an explanation of its functioning, reasons for the rejection of the alternative schemes will be given.

The operation of scheme (*a*) would not result in the entire dispensation of some sort of Reserve Fund, as it would be impossible, when sales are made on several markets at different and sometimes fluctuating prices, to make a first and final payment to the egg supplier. The main objection to such a scheme, however, is that in tying local to export market prices, the marketing body and the growers could well be making unnecessary financial sacrifices on the largest market. Some authorities in advocating a local price as near as possible to export parity frequently overlook the fact that in certain circumstances the lower price would not even induce any worthwhile increase in local sales. This would apply particularly in the season of flush production when backyard production is in competition with the commercial market. The difficulties are accentuated when the avenues of disposal are widened.

The objection to scheme (*b*) is that its operation would deny higher seasonal prices to those producers who supply the Board during the winter months, when the level of production is at its lowest and expenses at their peak. In other words, the principle aimed at is not the payment of a price on all disposals as near the average annual return per dozen eggs as possible, but to equalise losses on the less remunerative markets among all producers supplying during the flush season when a very high proportion of receivals are exported by most State Boards. Scheme (*a*) also suffers in that it does not meet the particular requirements of the flush and the off season.

THE SCHEME IN OPERATION.

Scheme (*c*) has been adopted for the reason that it does not suffer from the objections abovementioned. In practice it is impossible to arrange the Equalisation Reserve Fund deduction, which is on a per dozen eggs basis, so that there is no difference between local wholesale prices determined and paid to suppliers by the Board from time to time and actual realisations from all sales avenues. Consequently it is usual to budget for a surplus to cover contingencies, and at the end of the trading year a distribution of any surplus funds on the basis of deliveries to the Board is made to suppliers.

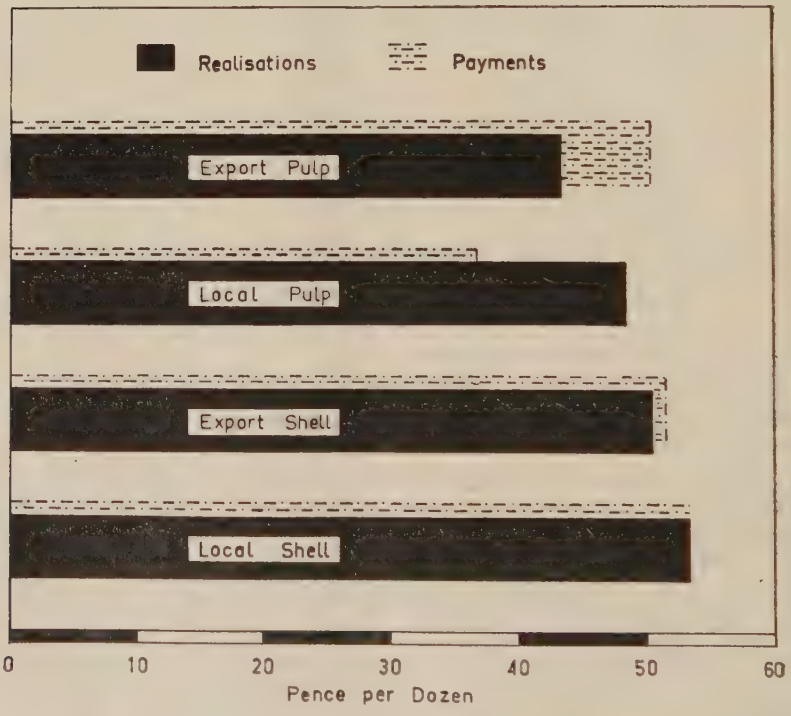

Fig. 1.

Average Realisations in 1952-53 by The (South Queensland) Egg Marketing Board on Various Avenues of Sale Compared with the Gross Average Payments to Suppliers for the Eggs Involved.

As the gross payment to suppliers at any time is identical with the prevailing local market price under the scheme outlined, it follows that the Equalisation Reserve Fund contribution per dozen eggs will be determined by the difference in the level of local prices and returns on other avenues of disposal, as well as the ratio which the volume of local sales bears to other sales. The level to which local prices can be lifted, however, apart from considerations of the economic factors of supply and demand, is limited. In the case of The South Queensland Egg Marketing Board during the flush season of 1953 (July to December), local sales in shell comprised only 34% of total receivals. A high deduction under such circumstances, although perhaps conferring an advantage to the supplier in that it maintains a satisfactory local price, particularly in times of low returns from overseas (as prevailed during the 1953 export season), results in such a margin between the gross payment (that is, the prevailing local price) and the net payments (that is, gross payment less equalisation deduction and other marketing charges) that it strongly tempts growers to sell eggs on the local market other than through the Board at a level quite often slightly below the price established by the Board. In addition, the organised marketing body is also now subject to price cutting competition from the uncontrolled backyard producer with less than 251 birds. A high equalisation deduction can therefore be a real danger to the Marketing Board.

In Fig. 1 is shown the average realisation per dozen eggs sold through each of the various avenues of disposal in 1952-53; with each has been compared the average gross payment made to suppliers for the actual eggs so utilised. As regards sales of eggs in shell, all eggs would be of 1st quality, whereas for pulp, in addition to 1st quality eggs surplus to local and export shell egg requirements, there would be included eggs of the lower grades.

It will be seen, as explained above, that under the Equalisation Scheme in operation in 1952-53, the average realisation on local shell egg sales equals the average gross payment to suppliers for those eggs, whereas there was a deficiency in both sales of eggs and egg pulp for export but a surplus on local pulp sales realisations.

In practice, generally, the cost of grading and selling to the point of sale ex the Board's premises is covered by the handling and selling charges. However, in the case of export and of pulp manufacture, extra costs are incurred, and these costs, in addition to the difference between gross payments to growers and average realisations, are made a charge against the Equalisation Fund.

In 1952-53 the overall charge against the Equalisation Fund to meet the deficiency on export eggs in shell was £60,136, while combined local and export pulp operations realised a net surplus of £18,307. (Separate figures for local and export pulp are not available.) To finance the Fund a total amount of £82,346 was collected from growers. The surplus after meeting some lesser charges to cover losses resulting from breakages, down-grading of stocks, case maintenance, etc., amounted to £34,445. This was refunded to growers.

It will be clear from the example that the amount of equalisation necessary to finance the immediate payment to suppliers of the current wholesale prices will be determined not only by the anticipated levels

of realisations from the various avenues of disposal, but also on the relative quantities it is expected will be sold through these avenues. In Fig. 2, the relative quantities so marketed in 1952-53 are shown.

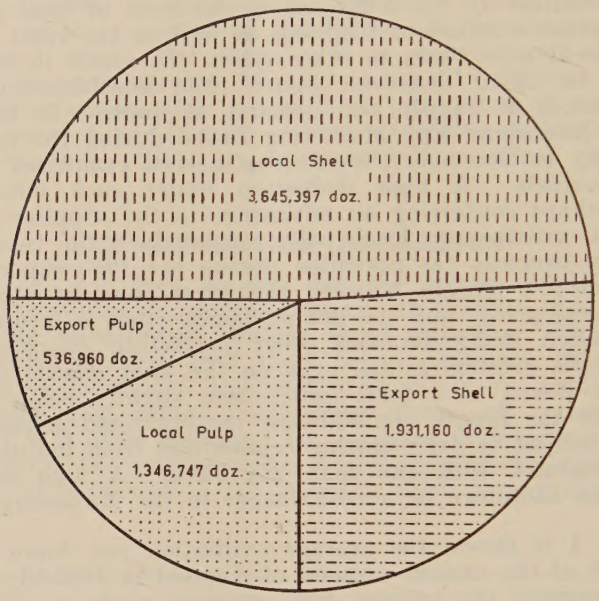

Fig. 2.

Dissection of Sales Made by The (South Queensland) Egg Marketing Board, 1952-53.

Above, the application of different systems of equalisation to egg marketing have been examined, and arguments in support of the system at present in operation advanced. In the light of these arguments, it will be of interest to trace briefly the historical development of equalisation since the establishment of The Egg Board under the Primary Products Pools Act in 1923, and to attempt a forecast of future developments in stabilising returns.

HISTORY OF EQUALISATION.

Since its very inception in 1923, the big problem of The Egg Board has been the disposal of production surplus to local requirements. Initially the policy was to pay growers an advance which was virtually a price which the Board conservatively considered would equal realisations less handling costs. At the end of the pool year, a final payment would be made. In the flush season, prices were reduced so that as many eggs as possible could be sold. For example, prices fell from 2s. 7d. per dozen on 1st June, 1923, to 1s. 5d. per dozen by the end of that month. In the following year a storage programme enabled the higher price to be held until 25th July (nearly a month longer).

So long as eggs were sold on the local market, the Board was able to regulate sales, but often only at the expense of severe price reductions. To stabilise the market the Board's policy was modified in 1926-27 by clearing the local market of surplus eggs by despatching to Sydney when that market was favourable and by export to the

United Kingdom. The cold storage of eggs for the local market to meet the demand during the period of short supply was also continued.

This policy had the effect of maintaining prices on the local market, but it also involved the Board in definite risks. The eggs exported were sold on consignment and returns were uncertain. Competition on the local market from outside the Board could also cause the collapse of prices at the time of release of cold store stocks, if production was high. To provide against the contingency of overpayment to suppliers, an export levy was inaugurated from 1st July, 1926, by a deduction of ½d. per dozen from growers' account sales. An agreement was also entered into in November, 1926, with the merchants, who as agents of the Board had sold in competition with it, to—

(1) Refrain from selling eggs by auction, advancing to their suppliers instead amounts not exceeding the ruling rates paid by The Egg Board.

(2) Deduct from their payments an amount of ½d. per dozen, which was to be remitted to the Board.

(3) Enter into a bond of £500 against breach of agreement.

Up till April 1928, however, suppliers to the Board's floor had to bear costs of quittances of surpluses to interstate and overseas markets, with the result that the average price paid to the Board's suppliers was on occasions 1d. to 2d. per dozen less than that received by suppliers to agent's floors. To overcome this grievance, an equalisation deduction of 2½d. per dozen (which was equivalent to 14% of the then current values) was deducted from all account sales to meet export and interstate transport costs of 9d. and 3½d. per dozen eggs respectively. As a matter of interest—the metropolitan agencies continued until 1943 when the National Security (Egg Industry) Regulations were gazetted.

With the increase in production in the 1930's and the intensification of the marketing problem arising from falling overseas values, it became necessary to keep a continual check on the equalisation/net return equation, with the result that payments to growers and equalisation deductions varied often from week to week. Notwithstanding, in some years losses were sustained by overpayment which had to be made good from the following years.

During these years when the trading risks were very real, no marketing board was sufficiently daring to raise local prices to a level very much in excess of expected realisations on export. The equalisation deduction consequently remained as a Reserve, against which unexpected losses as well as the disparity in realisations on export and local sales could be offset.

With the outbreak of war, after 1939 came Government bulk buying under contract with the British Ministry of Food. Under such conditions prices were given a degree of stabiliy which they had not previously enjoyed. The contract price also enabled the application of new principles in equalisation methods—namely as a price support for local sales. In practice, higher spring prices and high equalisation deductions were maintained, which meant in fact that a proportion of the subsidising of lower export prices was contributed by the consumer. This practice, however, apart from objections which have been outlined above, which

arise when the equalisation deduction is maintained at too high a level, can only operate efficiently so long as an outlet for production surplus to local requirements at reasonably guaranteed prices exists.

With the cessation of contracts, it will be much more difficult for the Marketing Board to budget. Of recent years it has been possible to virtually plan the sales/equalisation programme 12 months in advance, subject of course to supervision and periodic review in the light of actual production. With the return of open markets and trader-to-trader relations, many of the old difficulties are returning as a consequence of the uncertainty of overseas realisations, and during the coming season we shall most likely see a return to the former equalisation methods (that is, frequent reviews of deductions and the balance of the Equalisation Reserve Fund, perhaps more frequent changes in the Equalisation deductions, though possibly at a lower level, and a closer alignment between export and local price realisations.

COMMONWEALTH-WIDE EQUALISATION.

The principle of equalisation is not unique to egg marketing. The stabilising benefits from equalisation are also enjoyed by the dairying industries and on the wider national basis as opposed to the State basis of egg marketing. The operation of uniform Australian prices for butter and cheese enables this by removing competitive intersate selling, a practice which by virtue of Section 92 of the Australian Constitution Act can only be removed by voluntary co-operation of growers. Apart from the greater stabilising influence, the result of equalisation on a national as opposed to a State basis is the payment of uniform returns to producers throughout the Commonwealth irrespective of the avenues of disposal or by whom a sale is effected. Without a national basis of marketing, equal distribution of returns will be impossible in any industry which must dispose of production surplus to local requirements.

From the example of the dairying industry, it could be argued that the poultry industry of Australia would derive, as a whole, increased benefits from the extension of the equalisation principle to a Commonwealth-wide basis. As stated above, however, it is feared that unless uniform domestic prices are agreed upon such a scheme would not be possible so long as Section 92 of the Australian Constitution operates. In any event, it is difficult to see that such Boards as the Central Queensland Egg Marketing Board, unable to satisfy the demand in its own area of jurisdiction, or Boards in some other States with stronger local demand, would be interested in equalising with other marketing bodies compelled to dispose of surpluses on less remunerative markets, unless they were threatened by competition from other Boards or other producers in other States operating ouside their marketing organisation.

The control of exports by the Australian Egg Board is a matter which at the time of writing is receiving the close attention of the State Marketing Boards. Generally, the advantages of some co-ordinating body as a means of equalising and stabilising returns are accepted. A very real indication of the uncertainties of the export market for these eggs has been given during the export season just ended, the first for many years under free marketing in the United Kingdom. With the added problem of egg pulp prices in 1954-55, all Australian egg marketing authorities are giving very serious consideration to the means of achieving co-ordinated supervision and control of exports. What would be a more complete and logical development than the complete equalisation not only of export but of local returns?